POPULAR AVIATION

Including SOUTHERN AVIATION and AERONAUTICS

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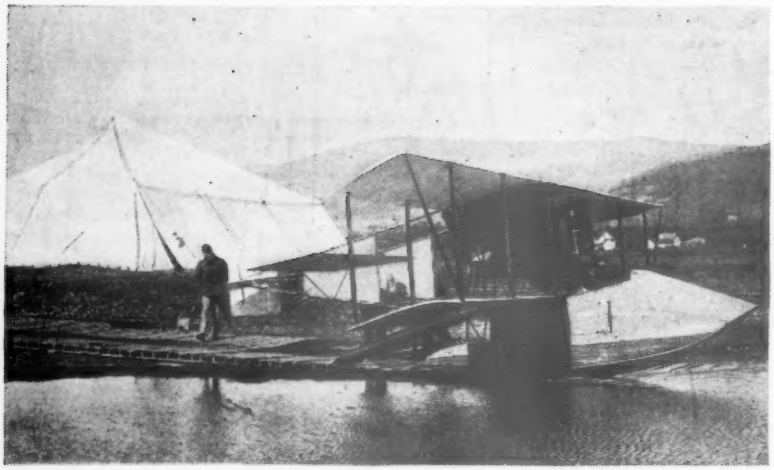
The Inside History of



The Navy "Bat-boat" A-2, the first amphibian and the forerunner of the NC boats. An experimental type developed by Curtiss at Hammondsport in 1913. Lieut. Ballinger in the background.

by

"STONEWALL JACKSON"

Aeronautical Engineer and co-worker with Curtiss at the early Hammondsport plant.

IN THIS era of perfectly appointed airports, up-to-date factories, expensive laboratories, elaborate college courses in aeronautics and well organized and lavishly equipped flying schools, it might prove interesting and even instructive to glance back across a long vista of years at the beginning of things.

In those days, the pursuit of aviation, equalling the pursuit of happiness in the uncertainty of its results, was still regarded by the public at large as a spectacular and oft-times thrilling variety of dare-deviltry for the ultimate benefit of hospitals.

Nevertheless, in spite of the admittedly precarious combination of the laws of gravity with experimental contrivances intended to defy the said laws piloted by blithely optimistic votaries of the art of flying, a considerable remnant of those gladsome harbingers of the aerial dawn managed to survive the ordeal and still continue to abide in this vale of tears and depression. Most of them bear the proud title of "Early Birds." And they were birds, indeed, all of a feather, and strenuously intent on catching the worms of pre-war days with many a splintering crash and groans of contentment.

Although a goodly number of those old-timers were actuated by an adventurous spirit which urged them to get away from a humdrum existence, in which attempt some of them succeeded to perfection and with amazing finality, quite a few others proved to be by no means devoid of brains, common sense and such knowledge of the flying game as was at that time available. This is a fact somewhat at variance with the conception cherished by the present day super-sophisticated aeronautical generation, but none the less true, for all that.

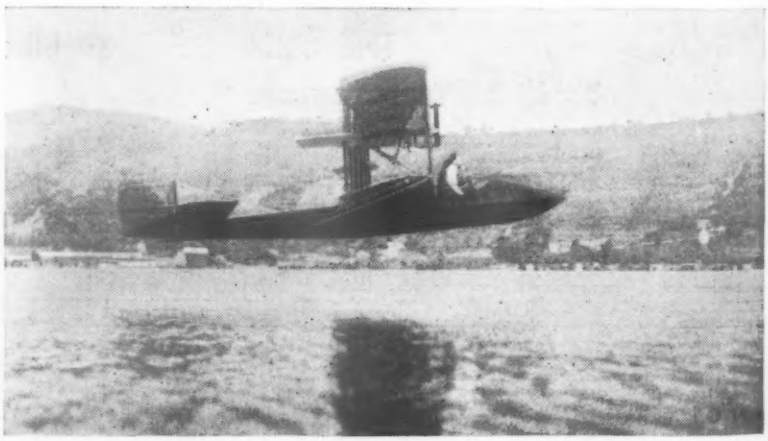
Some could even lay claim to that peculiar trend of mind, which for lack of better name, may be termed "originality." Originality, as everybody knows, is a mental condition which prevents the sufferer from doing anything twice in the same way. In other words, they would try anything once and very often get away with it.

Those early experimenters lacked the modern text-books in which are set forth the mathematized results of the very science they were so valiantly trying to originate and establish. And yet those surviving few possess a priceless advantage over the younger generation in that they personally experienced and struggled through that painful phase of growth and development which, carefully nursed along by a handful of daring spirits from very small beginnings, was soon to acquire noble proportions.

It is an inestimable advantage to have at one's disposal numerous hand books, reports, graphs, and classified information, pertaining to the minutest details of construction, to design and build an airplane these days. It is likewise a great boon to have the use of smooth-rolled fields extending almost as far as the eye can reach, concrete runways, parachutes, instruments, weather reports and triple-licensed airmen available at a moment's notice to test the plane after meticulous inspection by qualified experts.

And yet, when all is said and done, this ponderous array of science and organization is mainly concerned with the exploitation of planes, which in their essential features differ but slightly from those built twenty years ago. The old-timer who, by personal contact and through personal observation, has followed the progress made from the initial period of inception and struggle for recognition is forced to the conclusion that not only was the foundation laid and the way for subsequent development paved in those remote years of pioneering, but also that the most important and fundamental problems of development were likewise solved during that short period.

And in spite of his endeavor to maintain an impartial attitude, it appears to him that the work that has been done since, represents with but a very few notable exceptions, mostly a process of



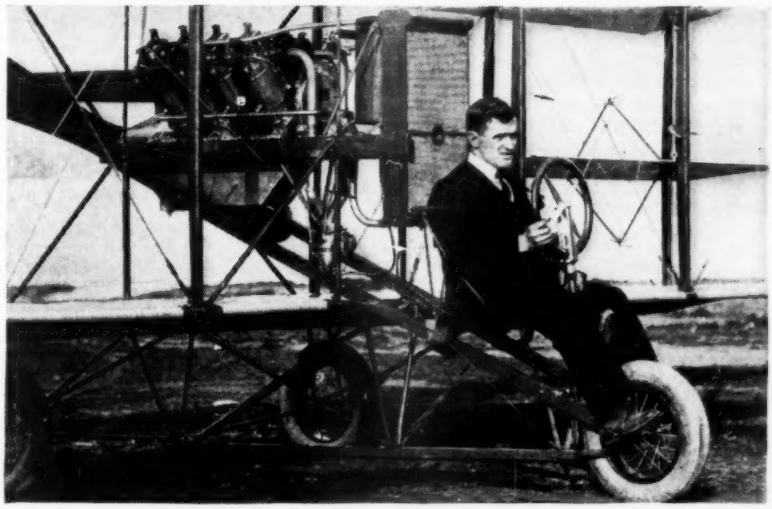
The first flying boat was invented and developed at the Hammondsport plant by Curtiss in 1911. Note that this first boat has no "step" in the hull. The step was a later development that made take-off easier.

Curtiss at Hammondsport

HERE is an intensely interesting story of early days at the Curtiss Hammondsport plant—at the time when revolutionary improvements were made over night.

The author, who drew his nickname from his famous crackup at the stonewall boundary of the old Curtiss field, participated in this early development work and recalls interesting incidents occurring in 1911, 1912 *and* 1913.

The title of this story might have been, "There is Nothing New Under the Sun," for on these early ships we see many items that many believe to be modern.



Here we have Lincoln Beachey, the peer of all stunt pilots, trying out the first of the famous "OX" series of Curtiss engines. Note the so-called "floating aileron" at the right. Beachey subsequently performed the first loop made in America with this machine in 1913.

refining and elaboration of already established designs.

In order to gain a clear idea of the manner in which progress was achieved in those early pre-war days, the reader is invited, in spirit, to make a pilgrimage to the charming village of Hammondsport in the up-lands of New York State, the erstwhile home of the Curtiss Aeroplane Company and the birthplace of its founder and moving spirit—Glenn H. Curtiss.

Nestling under the steep wooded hills which flank Pleasant Valley, broadened out to a sloping plain terminating at the southern extremity of the narrow Lake Keuka, the village lies snugly ensconced among the foliage of splendid trees and breathes a spirit of rural contentment. To the casual visitor it would seem the last place in the world to suggest a glorious past as an early center of aeronautical activity; nor would it appeal to the present-day airman as a likely location for an aviation school, since he would search in vain for the broad level meadows and unobstructed vistas usually associated with flying fields.

From the upper end of the main street he will be directed down a gently descending highway lined with tall trees to an open space called Kingsley field and he will be informed that this was the arena of action where many famous flyers of former years received their initial training.

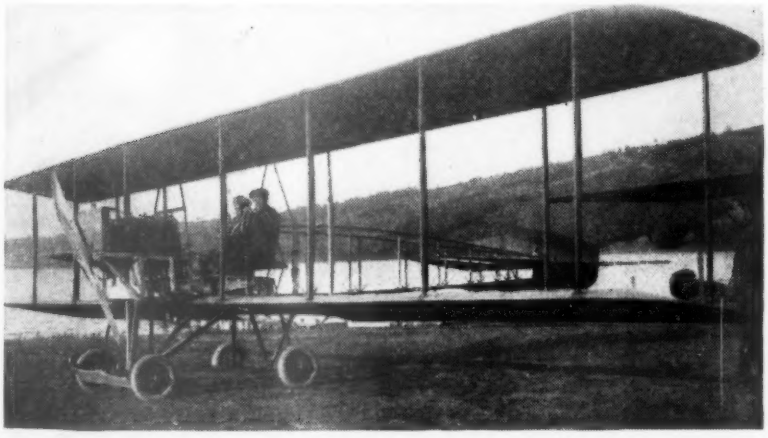
Standing at the hither end of the field, he sees a breast-high stone wall with trees and telephone poles lining the road immediately beyond it. In front of him, stretching away for three-quarters of a mile to the water's edge is a fairly level expanse of ground to the right, this ground slopes up and is mostly given over to vineyards and gardens which are bordered by another stone wall and road at right angles to the first ones with a similar array of trees and telephone poles.

Beyond this road, the hills rise abruptly to a height of several hundred feet. To the left of his point of observation the field is rough and uneven, and merges into the marshy grounds bordering on the inlet creek which meanders down the valley to the lake. Near the lake shore he will discern some frame sheds of simple construction, open at the front and serving as hangars for the well-known Curtiss Airplanes of the period. A runway and turntable for the hydro-airplanes complete the equipment of this primitive airport.

The actual space available for taking off and landing then was about three-tenths of a mile in length and at the most some two or three hundred feet in width. A tall and solitary elm tree graces the landscape between the serviceable part of the field and the creek, evidently placed there by nature with intentional disregard for the spacious requirements of the novice engaged in practising the art of making a turn on a low powered training machine having a ceiling of about fifty feet.

Whatever else the embryo flyer might do or omit to do, if he wanted to make a complete circle, he simply had to dodge that elm tree. Keep clear of the stonewall and the encumbrances beyond it, avoid settling down in the marshy grounds around the creek, give the vineyards at the opposite side a wide berth and refrain, as much as humanly possible, from over-shooting the mark and landing in the lake.

Considering that the machines of those days were not exactly fast climbers and that their reserve power was very small, the matter of getting out of the field required a good deal of judgment and practice in addition to a sound knowledge of the topographical features of the grounds. Mishaps would occur, of course, and disabled machines had to be dragged back to the hangars on numerous occasions, the



Well, well! Here we have the first Curtiss tractor plane all dolled up with a four-wheel landing gear. They didn't have time to cover the fuselage with fabric. Date: 1913.

would-be aviators, however, usually escaping with a few scratches and a lowered self-esteem.

The art of taking off and landing was drilled into the aspirants for aerial honors by the instructors under the ever-watchful eye of Glenn Curtiss; beginners were started out soloing right off the bat in low powered machines, with engines throttled down, to practice straight runs and hops and to familiarize themselves with the controls. A drag brake was supplied to stop the machine before it hit the stone wall. If the brake did not work, or was applied too late, the run would be checked by a rope stretched a few yards along in front of the wall; and if the rope proved powerless, the stone wall, as a last resort, would stop the machine very effectively.

Usually, one crash like this was sufficient to teach the pupil to use better judgment in the future. Landings in the lake were not so harrowing, but still attended by enough excitement and discomfort to carry their point.

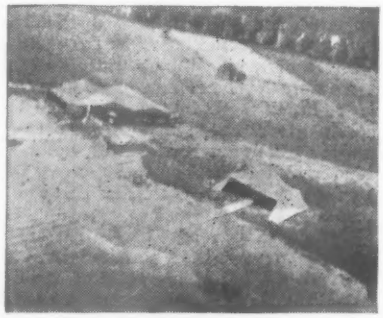
If practice on the land machines was beset with many obstacles, the same could not be said for the hydros, for surely a more perfect place than the calm expanse of Lake Keuka could hardly be found elsewhere, and this more than made up for the deficiencies of the field. It is therefore not surprising that the hydro-airplane originated in Hammondsport, which also witnessed the conception and development of the flying boat by its inventor Glenn H. Curtiss.

It is fair to presume that aviators of the present era, accustomed to the commodious seating arrangement and the protection offered by fuselage, windshield or cabin, would feel particularly uncomfortable if they had to ride in an old-time Curtiss pusher machine, perched as he would be in front of the radiator on a little canvas covered frame fastened to the diagonal members of the chassis without a trace of a shock-absorber. And in addition one front wheel equally bereft, that precious front wheel that should never be bumped in landing if a series of disquieting kangaroo-hops were to be avoided.

A group taken at Hammondsport in 1913. LEFT TO RIGHT: Lansing Callan, Henry Keckler, Lieut. Goodier, Lieut. McLeary, David McCullough, Haldemann Figelmessy, J. D. Van Vliet (author of this article), "Oliver," Adams, Glenn H. Curtiss, Lieut. Parks, Lou Cranite, Lincoln Beachey, Doc Wildman.

Those were the days of the good old Curtiss control with foot-throttle and aileron-shoulder-yoke, an arrangement which developed a sense of balance in the student impossible to attain with the now universally employed stick control and foot bar.

Disturbances in the lateral balance of the machine were corrected by the aviator leaning over toward the high wing; which was a natural enough movement to make. When banking on a turn however, he was supposed to sit tight which was rather contrary to his instinct of self-preservation, and furthermore he was expected to help the banking along a bit by leaning over toward the low wing, but *not too much*, lest a side-slip should put an end to his evolutions.



The Curtiss Hammondsport flying field in 1913. This is the first aerial photo made in the United States from an airplane.

The hydro was provided with a dual control, instructor and pupil sitting cosily side by side, an ideal arrangement which enabled the instructor to watch the pupil closely, and to bump him or kick his shins if he neglected to ease up on the throttle while attempting a landing. This may seem a harsh procedure, but sometimes it was necessary and saved the day for both.

Amusing contrivances, no doubt, when viewed through the mist of time, deserving perhaps the pitying smile of these latter day tractor-trained pilots. And yet we thought a great deal of those machines in the old days, and for some reason, we still do. One who had learned to handle those machines aright and could take off and land in the restricted, obstacle-beset area above described, was well qualified to meet any emergency.

Those who had the privilege of witnessing expert flyers like Curtiss or Beachey pushing those early machines through their paces, could not but marvel at their wonderful performance, and realized that much could be accomplished with primitive appliances if handled by thoroughly competent men. And in those days the business of flying was 99 per cent man; the aviator having to rely entirely on his own caution and good judgment, which qualities were the keys to a successful performance. To go easy and be cautious, was the admonition constantly tendered to over-ambitious novices by the naturally cautious Glenn Curtiss.

And thus we love to remember him, straight and spare of frame, somewhat

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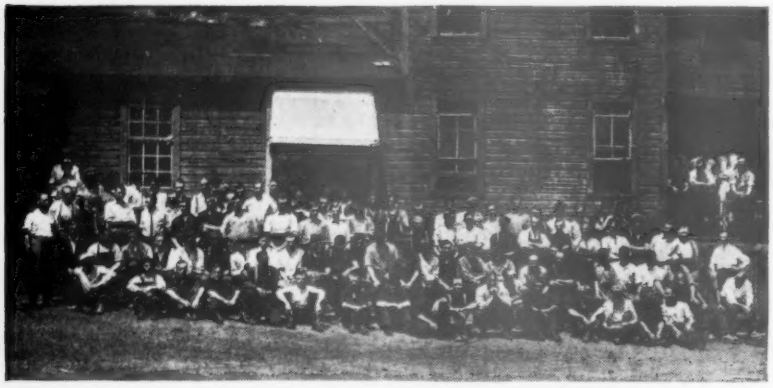

The complete personnel of the Curtiss factories in 1913. Among this group of workers are many who later became famous in the aeronautic industry.

Bombing in the World War

by ALFRED CELLIER

This interesting article tells just how bombing rapidly developed from comparative obscurity to one of the most important arms of the air-service.

THOUGH the airplane, in the early days of the World War, was used primarily for reconnaissance with little thought given to its armament, this was not so in the case of its employment as a bomber.

The first bombing in the World War started during that hectic month in August, when Lieutenant Immelmann, flying a Taube, released some small bombs on Paris. Aerial Bombing, however, actually dates back to 1911 when the Italians used this mode of warfare during the Tripolian Campaign and Immelmann adopted their technique. All of these early bombs, of course, were dropped by hand or hurled over the side of the airplane.

The first aerial bombs were generally homemade affairs or constructed from rejected artillery shells. Flechettes were also used in the beginning. These were pieces of steel about as long as a pencil, one end of which was sharpened. About two-thirds of the length of the Flechette was grooved, allowing it to fall in a straight vertical path.

Although frightful wounds were produced, their radius of destruction was so limited that they were replaced by explosive bombs. In any case where a column of cavalry was attacked by Flechettes, it was found that they penetrated he steel helmets of the riders, and went right through both the bodies of the soldiers and the horses.

A Type 14B2 Breguet bomber of the 96th American bombardment squadron ready for a trip over the lines.

With the necessity for greater accuracy and with the constant increasing size of bombs, it became imperative to devise some sort of bomb-dropping gear. Up to the advent of such apparatus, the bombs were carried vertically in the interior of the airplane by racks. With the new gear, however, it was possible to provide bomb racks out under the wings; and in the larger bombers, to be carried very much as in the present manner.

Recognizing the value of long distance bombing, the Germans succeeded, three months after the outbreak of war, in reaching the British coast and dropped several bombs near Dover. This took place six months before the first Zeppelin raid on England.

Early in 1915, bombing started to become stabilized in comparison with the other branches of aviation. The first night raid took place at Dunkirk. Immediately afterwards, formations were employed for bombers for about a year previous to any such formations by pursuit units.

Sea vessels came in for their share of this early bombing, in spite of the general impression that no surface ships were attacked during war-time. In the first year and a half of conflict, the Russians bombed and sank a German destroyer. A German mine sweeper was sunk by a bomb from a British plane, the Turkish battleship "Barbarossa" was set on fire by aerial bombs, while four other smaller ships were bombed and sunk in the Sea of Marmora.

Besides the bombing raids engaged in by the Zeppelins, many such raids were made by airplanes in the year of 1916. Although these raids were not consequential, they were the foundation of the present day bombardment aviation. Some, without doubt, had no tactical or strategical value, such as the raid by the Bulgarian and Austrian air units on the camp of the Australian and French troops at Saloniki

This camp was severely damaged by the fire which broke out, but no attempt was made for ground strafing the troops during the confusion which ensued. No further attacks were made on the same objective during the re-

Loading the bomb racks of a Gotha bomber in preparation for a raid over the Allied lines.

building, which might have caused a change of location for the encampment. As a result, the effort was a complete military failure.

Shortly after this, three British naval airplanes made a trip of 300 miles in order to bomb Constantinople and Adrianople, still further north, in an attempt to destroy the large powder mills and the airdrome which were located there. The distance covered during this raid was a remarkable feat, but with the exception of demonstrating what might be expected of aircraft, no military damage of consequence was done.

French squadrons then engaged in a two day raid in an endeavor to break up the railhead at Nantillons and Brieulles. Most of the damage resulting from this raid was confined to the buildings of the city which suffered materially. Other raids of consequence during this year took place at Kantara, Egypt, where there were many casualties and also at Bar-le-Duc.

Toward the end of 1916, with larger bombs and better equipment, the attacks grew in intensity. During the attack on Mariakerke, sixteen Allied planes dropped thirty-eight 100-pound bombs and seventeen 65-pound bombs, while the Solvany works at Zeebrugge were attacked by seaplanes with bombs of a similiar type. The Germans, with their seaplanes attacked Calais, dropping bombs on the port and the cantonments. Another German raid of magnitude was made on Reval. Seaplanes were used which bombarded military works and war vessels in the harbor. One submarine was hit four times, but none of the surface vessels were sunk.

Whereas these attacks, up to 1917, were of little military value, the appearance of the Gotha and the Handley-Page, in that year really put bombardment aviation in a distinct service by itself. With a bomb carrying capacity of nearly a ton, these bombers were very formidable weapons. The Gothas proceeded to carry out many raids on the French and English seaports and cities.

On one particular daylight raid on Paris, the Gothas dropped fourteen tons of bombs on that city. The civilian populace bore the brunt of that attack. Scores were killed and wounded in the streets and in their homes, while many homes, schools and hospitals were destroyed.

Loading bombs on a Breguet bomber of the 96th American squadron, making ready for a trip of destruction over the German manufacturing centers in the Ruhr district.

The raids on London took place with thirty to forty of these huge machines. The propriety of German bombing tactics allowed that any enemy city was a military target and they maintained a continuous war against helpless civilians. These ruthless raids, always leaving maimed and killed, caused the British to keep protective squadrons at home that should have been in France. On one raid, however, one of the home defense squadrons, engaged in defending London from these attacks, shot down seven German Gothas.

In addition to the Zeppelin raids on England, the German bombing planes made fifty-seven raids. The casualties resulting from these attacks, amounted to 1,117 men, women and children killed, and 2,886 injured. Of these, only 296 of the dead and 521 of the injured were soldiers.

The Zeppelins, made 51 raids on England. These resulted in 498 men, women and children being killed and of this group only 58 were soldiers.

The advent of the Handley-Page bomber was a disheartening affair for the British. As with all other airplanes sent to the front, it was flown across the channel only to alight on the German airdrome at Laon. Whether it was flown there by mistake or by treachery, has never come to light to this day.

Its capture gave the Germans the inspiration for the Gotha bomber. The constant flying of it and the sham attacks by their scouts, brought out its good and weak spots, so that they knew what they were up against. After that lesson, the British never let an experimental plane get out of England until it was on a full production basis.

In spite of that first misfortune, they proved their worth many times over. One of the most successful raids by a ship of this class took place in 1918. Starting out from England to Paris, it flew down the Rhone valley to Marseilles then to Pisa and finally to Rome, Italy, where it landed for fuel. Leaving Rome, it flew over Naples and Oranto to Salonika where were based other Royal Air Force units. There, preparations were started for a raid on Constantinople, 250 miles distant. Their objective was reached after two and a half hours of night flying over hostile territory. Over the sea of Marmora, they released four bombs on the battle cruiser "Goeben" from an altitude of only 800 feet.

Hits were made on two submarines and the transport "General," which was the headquarters of the German General Staff, was set on fire. Two bombs also hit the Turkish War Office doing considerable damage. In all there were thirty bombs loosed over the capitol. It was found, on the return, that the plane had been struck in twenty-six places by shrapnel, and one of the power-plants was so badly disabled

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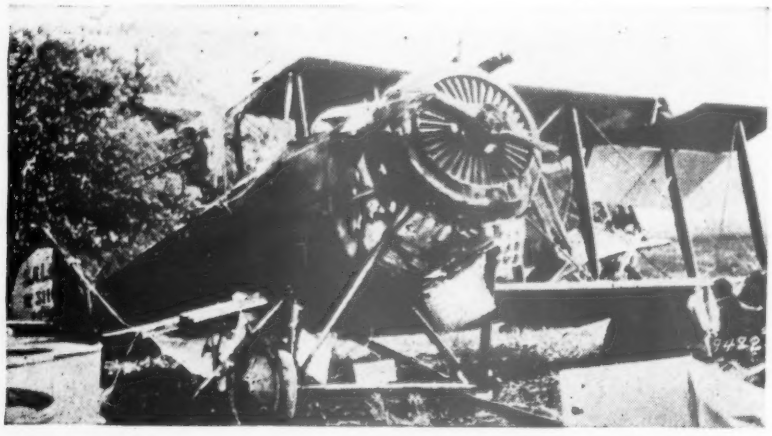


After the German bombing raid on the 96th American squadron, this Breguet bomber was wrecked. The next night, the 96th squadron paid the same sort of raid on the German airdromes.

The Popular Roscoe Turner

by JAMES FARBER

An intimate study of aviation's most versatile and well liked pilot who wrestles with full grown lions when not wrestling with the controls of his racing planes. And he's a real colonel at that!

COLONEL ROSCOE TURNER, flyer par excellence, ace record holder and the fastest man between New York Bay and the Golden Gate, is just the same fellow he always was to those who "knew him when—."

Just plain "Roscoe" despite all the medals he wears and the records he holds.

He has the same friendly, affable personality that drew friends to him in the old days like bargain sales draw women. He is the same "guy" that went on parties and spoke on equal terms with Big Shots even before he himself landed in a big way.

He is one of the few flying "celebs" that newspapermen have no aversion to. And they have plenty of aversions where the great and near-great are concerned. So many of these other famous men and women forget there ever was a "time when."

Roscoe Turner is good copy any day in the week.

He has a legitimate claim to his Colonelcy. It was presented to him in 1930 by the governor of Nevada on whose military staff he served. But he also served in the army during the war and therefore has more right to wear a brevet than plenty of men who bear similar titles and who were miles away when the Big Call came in 1917.

Roscoe got his start—appropriately enough—in Dayton, Ohio, birth scene of the Wright Brothers' first airplane. But this word "start" should be qualified. He was already a veteran pilot and possessed of every qualification that makes for success in this great game. It was in Dayton that he took his first step toward playing a spotlight position in the Big Time Circuit of aviation.

Rene Fonck, peerless French war ace, invited Roscoe to be his co-pilot in a transatlantic venture. It was a signal honor. Here was the greatest airman of France proffering to an as yet unknown American flyer the honor of flying with him on a dazzling mission that bade fair to heap honors and encomiums on its successful participants.

Roscoe says it was the hardest "No" he ever said. Can you imagine being in a position to turn down such an invitation? It took plenty of sand to do that . . . to turn a deaf ear to Opportunity's priceless knock.

But Roscoe had a hunch. He is not a hunch flyer, but that time he had one and acted on it. And the venture of Fonck came to a disastrous ending, as has been recorded on the bright pages of aviation history.

How this lion has grown since Col. Roscoe Turner flew a transcontinental record breaking trip with him in his cub-hood. A strenuous wrestling partner, we'd say.

Roscoe was a dejected pilot immediately following that refusal. He wandered around New York trying to console himself. Along came a Deus ex Machina in the form of Al Johnson, at that time owner and operator of the Johnson Airplane and Supply Co., with a modest field on the Wilmington pike outside of Dayton.

"Come to Dayton with me," said Al.

"Spoken like a gentleman," Roscoe replied. And the two returned to the Ohio city.

Roscoe's natural sense of showmanship was keenly alive in those days just as it is now. He was even then wearing his famous uniform.

He personally designed and had tailored, a complete change of togs that combined the best features of the military officers' uniforms of the American, English, French and possibly Scandinavian armies. On the subject of Scandinavian, the Colonel is silent . . . probably because he has never been asked about that.

This uniform is an integral part of Roscoe Turner and of the Turner Legend that is already beginning to grow up. No description of him is complete without particular attention to that matchless raiment. It would be like telling the story of Julius Caesar and leaving out his pride and joy—the Tenth Legion.

Like the Turner mustache, the uniform is Roscoe Turner all over. A lovely and seductive Robin's egg blue in color, it is every square inch the product of his quick eye for sartorial elegance. He wears it every place he goes. And he is gazed upon; and necks crane and turn to see him—unbelievingly. He knows that—and presumably likes it.

He wears a heavy Sam Brown belt and over his left breast pocket is a pair of wings—also his own design.

And his cap crowns the glory of his tailoring achievement. It is, indeed, an inspiration—that cap. In the spot above the visor, where distinctive ornaments are usually found on military caps, Roscoe has caused skillful fingers to fashion a set of eagle's wings bracketing the initial "T" with a superimposed "R".

Roscoe says if you don't know who he is by the time you see those initials —it doesn't matter. And he only grins when facetious newspapermen ask him when he's going to emblazon "Roscoe Turner" on that cap.

In Dayton, Roscoe met William Preston Mayfield and Fred Albert. Both were staff photographers on a local newspaper, but were nationally known. Mayfield was already rated an ace aerial photographer.

Roscoe saw a chance.

"You and I could draw down heavy money on a photographic barnstorming trip in these parts," he told Bill.

"I think we could," said Bill. "What'll we do for a ship?"

"I've got a ship," Roscoe said. And the deal was on.

Roscoe indeed had a ship. It was an old Standard powered with an OX-5. The two men hopped off in it, with Turner at the controls and Mayfield in the spare seat smothered in cameras and paraphernalia.

Charles "Slim" Gregory was the contact man. The two partners followed in Gregory's wake all over Ohio, Indiana, West Virginia and Kentucky. It was a clean-up. Firms everywhere poured in orders for aerial views of their industrial plants and enterprises.

Dissolution of the partnership came when the four states had been photographed commercially nearly five hundred times. Bill Mayfield returned to Dayton. And Roscoe Turner sought new worlds to conquer.

In Hollywood he was a big hit. He was still a free lance pilot but he was known as one of the best in the game. He was hired to do some of the stunt work in "Hell's Angels," one of the super-super air-war films.

The producers gave him a giant Sikorsky dressed up to look like a bombing machine of war times. It had machine guns, bombs (dummy), plenty of camouflage and false superstructure.

He had, indeed, a swell time, Roscoe says. But he was busy in other ways, meantime.

As naturally as steel gravitates to a magnet, friends surrounded him. If his uniform hadn't attracted people as it did on Hollywood Boulevard—one of his favorite strolling grounds, his personal charm would have. The man collects friends like a room collects dust. They can't keep away.

It wasn't long before he had a big slice of the private pilot work to be done in the movie colonies. Executives, stars and directors engaged the services of the man most of them had seen doing dangerous stunt flying.

Constance Bennett, Bebe Daniels and Miriam Hopkins are among the best known of his friends. To list those for whom he held a steady stick throughout many an aerial trek over California mountain ranges would be to give a resume of the Who's Who of Hollywood.

A world-famous picture actress financed his Wedell-Williams racing ship. In it he carried a lion cub across the continent—a typical example of the astute Turner showmanship. That baby lion attracted photographers like Marlene Dietrich dressed in male attire.

Last year he flew Miriam Hopkins from Los Angeles on a transcontinental jaunt. He reached Port Columbus in almost record time. But there was dirty weather reported ahead in the Pilot's Graveyard reaches of the Pennsylvania mountains—and Roscoe is never a reckless flyer.

So the movie queen deplaned at Columbus and entrained for New York. Meanwhile, Roscoe hopped down to Dayton for a roaring good time with some of his former cronies. What his old friends like best about him is his long memory.

During these hectic days, heroes are made and unmade in a twinkling. Celebrities mount the ladder of success and many of them are deaf to the appeal of "auld lang syne." If you used to know Roscoe Turner in the days gone by, you are as likely to have him descend on you with no notice as you are likely to have your neighbor borrow your best piece of balsa wood to complete his latest plane model.

But the flying colonel's visit will bring you plenty of fun and a carload of laughs. That's the kind of a guy he is. He doesn't say much about what he'll be doing to surprise the public in the seasons to come.

Carole Lombard, well known film star, bidding goodbye to Colonel Turner after their flight from Carson City to Los Angeles.

He's likely to tell you that story about the time that he made the front page of the papers when he scored a technical knockout over an old wartime Jenny.

On this occasion, he took off from Curtiss field in a 6-passenger Sikorsky, ramming a Jenny trainer, which as usual, was standing in the way. They were right careless how they parked their ships in those days, particularly with JN's.

Well, anyhow, when the dust cleared away, the Jenny was a real wreck. The JN's prop was smashed, the OX-5 was driven clear back into the fuselage and other parts of the Jenny were smashed up as well. On the other hand, the Sikorsky also received a dislocated right wing and one of its metal props were broken.

But one thing there is that any outsider as well as insider can predict:—The Turner Legend will continue and its greatest protagonist will keep his top notch position as the most dashing figure on the contemporary American aviation scene.

Here we have Roscoe Turner, his lion in the big cage and his two planes. The ship in the foreground is the transcontinental record breaker.

What Ails the Pilots?

TO WHAT diseases or "Occupational ailments" do professional flyers fall heir? That is, those who have made a life's work of flying?

There are a number of occupational ailments incident to flying which have been noted as occurring to an unusual degree among military flyers. Army medical men say that the casual flyer who takes off as he wills, or persons flying closed cabin and soundproof planes—those whose flying is markedly different than that performed by military flyers—will not be affected in the same manner.

The military flyer, spending many years in tactical flying, can look forward to certain "diseases," the medical men say.

While there is probably no "disease" peculiar to the flyer, there are certain diseases which are so frequent in the profession as to merit being considered occupational. Strain, intensified by bad weather conditions, extra hazardous flying, flying over difficult and dangerous terrains, flying new ships under new and changing conditions are all factors that combine to afflict the military aviator.

Flyers often develop an anxiety neurosis and even more frequently a neuro-circulatory asthenia or "staleness." Other diseases or conditions to which they are subject are: Pterygia, or growths on the eyes due to wind blast. Photophthalmia and snowblindness when flying over snow covered terrain or over bodies of water.

Deafness and ringing of the ears are common conditions among flyers due to the constant roar of the engine. And the Eustachian tubes are often blocked after many changes in altitude. Ruptured eardrums are quite frequent, due to inequality of air pressure in rapid dives made by pursuit pilots especially.

The development of an hypertrophy, or enlargement of the turbinate bones of the nose, is caused by changing temperatures of the air inhaled. Sinusitia may also be caused by the same conditions which also tends to interfere with the circulation of the blood in the membranes lining these sinuses.

Various types of gastric neuroses are fairly common probably due directly to the nervous strain of military flying. Renal calculi or kidney stones afflict many military pilots although the reasons have not been definitely determined. It is thought to be due to the posture of flying, the lack of fluid consumption and changes in temperature encountered.

Due also to the sedentary nature of the work performed as well as the lack of frequent fluid rations is constipation. The effects of the above diseases are cumulative and increase with the period of time spent on flying duty, the medical men state.

The Flying Cops of New York

by JOHN GOLDSTROM

Deeds of daring and mercy performed by the well equipped and disciplined aerial police of New York City as set forth by an authority on police organization.

ELIJAH with his Flaming Chariot is the patron saint of French aviators. But the New York air police can claim a still more ancient symbol, in the mythological Winged Bulls of Assyrian art.

Probably the ancients were not up on the slang that makes a policeman a "harness bull"; but neither is it likely that the heaven-bound prophet of 900 B. C. was interested in aviation.

The beat of a harnessed cop covers a few city blocks. The winged cop patrols the sky over the New York metropolitan area. In this new field he is already doing things which may be the material of future legends. The present chronicler, would have hesitated to offer to an editor the plot of the following story if it were not a matter of police record.

On August 20, 1931, former Municipal Court Judge Hazelton of Brooklyn reported the disappearance of his 15-year-old son, Edgar. He advertised a reward of $2500 for his return. On August 24, his telephone rang. A voice, obviously disguised, asked:

"Are you the guy that offered that reward?"

"Yes."

"Well, if you want your boy back, go to (naming a place), and there you'll find a cigar-box. Open it. And mind you, no monkey-business!"

Judge Hazelton went to the place named. He found a cigar-box and opened it. Inside was a carrier-pigeon with this note:

If you are on the level, tie a $500 bill to each leg of this pigeon, and release it. Then await further instructions.

The judge released the pigeon; but that which he tied to its leg was not a $500 bill but a note, demanding that before he sent money, the supposed kidnappers send proof that they really had his son. Again his telephone rang:

"Didn't I tell you, no monkey business?" snarled the same voice. "You get just one more chance. At (naming the place) you'll find another cigar-box. If you want to see your boy alive, send us the money."

Judge Hazelton told the police. The only way to trace the criminals was through the carrier-pigeons, which seemed impossible. It would have been impossible without the Air Division. When Judge Hazelton found a second pigeon, and released it, two police planes, hovered overhead, piloted by Otto A. Kafka (who later won fame in rescue work following the Akron and J-3 airship disasters) and by Allen Van Hagen, then chief pilot of the division.

The New York police amphibian stands ready for active service on a moment's notice.

The flying detectives followed the pigeon—a difficult and hazardous chase, particularly when the bird flew low over the house-tops. It was hard to keep it in sight. Several times, one pilot or the other thought he had lost it, but, each time, his companion had managed to keep an eye on it. Finally, the pigeon dropped down over the Long Island suburb of Jamaica, settled upon a rooftop, then strutted into a dovecote. Carefully the circling air police noted the exact location. Then they landed.

"Mein dovecote? Vy, I rent him to another feller," said the German householder. "He comes every day."

So, in the dark attic, the detectives waited. Steps sounded upon the stairs. A head and shoulders appeared. A sudden rush, a startled cry, a struggle, the sound of blows, then—the click of handcuffs.

So, on April 22, 1932, George Marthens began a five-year-term in Sing Sing for attempted extortion. Long before that Judge Hazelton's son had returned from an unannounced hiking trip. He had never been kidnapped at all.

The account of this remarkable innovation in police work went to police officials the world over. Not long afterward, Frau Holle, wife of a factory owner in Bochum, Germany, received a cardboard box. Inside was a carrier-pigeon, with this message:

If within ten days you do not send us 500 *marks by this carrier-pigeon, your house will be set on fire.*

Frau Holle reported to the police. They told her to release the pigeon. Like their New York colleagues, they followed with two airplanes. Also, on the ground, followed two automobiles with radio-receiving apparatus. From the planes they received reports of the pigeon's landing. Surrounding the house, the police arrested two brothers, who were convicted, despite their denials, when the police demonstrated that theirs was the only dovecote the pigeon would enter.

* * *

THE stealing of Russell Garretson's cruiser yacht, on May 30 last, resulted in pursuit and capture by air police in a manner that would have done credit to a movie thriller.

When Mr. Garretson, who operates a marine excursion service, discovered that his 42-foot cruiser had been stolen from its moorings at New Brunswick, N. J., he enlisted the services of Kenneth R. Unger, and a friend, Charles Appleby. They took off in a small plane from Hadley Field, flew along the Raritan, across Staten Island and over the Rockaways. They saw the yacht in an inlet off Broad Channel, Jamaica Bay. Turning back, they landed at Floyd Bennett Field, where they reported to Captain A. W. Wallender. Captain Wallender, Pilot Peter Parranova, Sergeant Joseph Forsythe and Mechanic Frank Harkins took off in an amphibian and followed the lead of the searchers.

When the police plane landed beside the stolen yacht, two men jumped from its deck into a rowboat, and started for

shore. The police plane taxied across its path, and the men surrendered. They gave their names as George Moorehouse, of Jersey City, and Philip Calmeatto, of Brooklyn, and were held for trial by the New Jersey courts.

* * *

DETECTIVE work is only one of the functions of the air police, which in New York was organized principally to enforce the aerial traffic laws, as a safety measure. They have developed a special function as lifeguards of the air.

Along the northern New Jersey coast, a 45-mile off-shore wind roared out to sea. It filled the raw air with scudding spray from foam-topped gray waves, boiling and crashing angrily under a lowering sky. Beneath that ominous low ceiling a man-made creature of the air fought for its life in the gale.

It was April 4, 1933. The night before, the Akron had gone down in the storm. Hoping to save survivors from this greatest of all the airship disasters, the Naval Air Station at Lakehurst had sent out the small non-rigid dirigible J-3. Its crew of seven now were in danger of losing their own lives. The blimp had little chance in a gale that had destroyed the much larger and stronger Akron.

The wind, increasing in violence, fearfully strained the small airship. At noon a cry of alarm told Lieut. John M. Thornton, pilot, that the J-3's port engine had begun to move in its mounting. Anxious examination revealed that a plate had sheared through. An emergency repair job lashed strut and outrigger.

They were fifteen miles out to sea. Their scanning eyes had seen no trace of Akron survivors. The wind grew more terrific. Reluctantly they decided to turn for shore. Now, even their stout hearts beat with alarm. They had been running with the wind; they were now headed into it. The port engine was making only half-speed. When the wind abated a little the J-3 could make five knots; when it rose again she could barely hold her own, but made no progress.

After this struggle had lasted for some time, Lieut. David E. Cummins, commanding, concluded that his ship was lost; that the crew had a chance for their lives only by landing on the ocean near some vessel. But Lieut. Thornton thought shore might be made and the airship saved. Those aboard looked death in the eye, and chanced it.

Slowly the J-3 battled the wind, got over the beach. There had gathered a crowd, led by Lieut. Comdr. R. E. P. Elmer, U. S. N., retired, to form a volunteer ground crew. From the control car the J-3's threw down a drag-rope, then a steel cable. The crowd seized both and began to "tail on."

Overhead, the dirigible's engines throbbed, holding her as steady as possible. Then the crew took the last emergency measure: they pulled the rip-cords. A great gaping wound appeared in the side of the bag. Gas began to escape. Gently the blimp settled toward earth. It looked like a successful landing—prey snatched from the teeth of the storm.

Suddenly there was a shrieking, howling gust of wind. It struck the gas-bag amidships. A terrific tug at the cable. A wrench that knocked down many of the ground crew. Then a blinding flash.

The trailing steel cable had struck electric wires. The shock loosened the last hands.

The storm had won. Helpless, the J-3 cowered like a wounded animal before the final blow. A second blast struck. It dashed the blimp to the ground. But there remained gas enough in the bag to make it rebound, a hundred feet into the air. Another gust of wind. The horrified crowd saw the J-3 carried out to sea. A thousand feet from shore it fell, striking the water at fifty miles an hour. It rebounded, struck again; then, helplessly, settled down upon the water.

The control-car overturned, throwing its occupants to the mercy of the waves. Seven names added to the death roll of the Akron disaster, so it seemed.

Horror-focussed eyes saw only the men struggling in the water. Their danger had come from the sky; now from the sky came hope of rescue. Out from shore sped a small amphibian. It circled twice, then glided down to a landing on the rough water beside a raft onto which four of the seven had scrambled. Two men in the amphibian pulled them, one by one, to the plane's boat deck, a narrow surface between the pontoons, varnished, slippery, and soon awash with their added weight.

"Get the other three!" the rescue men implored, through chattering teeth.

"We'll do our best," said the rescuers. They searched the heaving waves that threatened to engulf the cockle-shell flying-boat. They dragged one more aboard.

But they could do no more. Water was getting into their motor, and several of the cylinders were missing. When Pilot Kafka started to turn the plane around on the water, one of the rescued men fell overboard, and had to be rescued once more. Lieut. Cummins and Pasquale Bettio of the blimp crew could not be found.

Precariously, bearing the five rescued men, the little amphibian headed into the wind and taxied over the waves to shore. Then, for the first time, the crowd saw upon its fuselage the word POLICE. Pilot Kafka and Sergeant Joseph W. Forsyth had been searching for Akron survivors when they saw the plight of the J-3. Their rescue of most of the blimp crew was one of the outstanding jobs of the Air Service Division of the New York Police Department. Kafka and Forsyth have been harvesting medals and awards, and continuing to patrol their beat.

(*Concluded on page* 124)

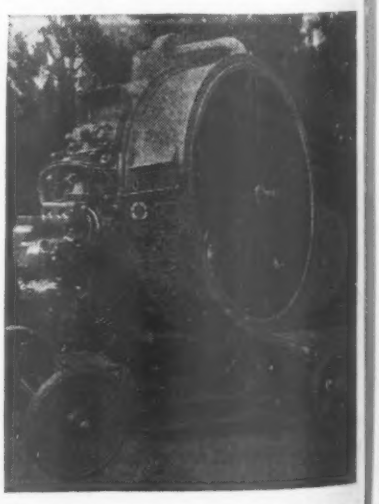
War Department Purchases 104 Searchlights

Standing back of the mighty 800,000,000 candlepower beam of a new Army searchlight.

AN important step in the modernization of our Army was taken when the War Department awarded contracts to the Sperry Gyroscope Company for 104 sixty-inch high-intensity anti-aircraft searchlights costing $2,015,900.

These are the largest and most powerful searchlights in the world. 61 searchlights will be mounted on trailers and 43 will be of the mobile type, mounted on a small chassis which can easily be loaded on a truck. These searchlights can be operated anywhere that it is possible to drive a truck as current for the searchlights is supplied by a generator driven by the power-plant of the automotive trucks.

The power of each light is 800,000,000 beam candlepower, the result of some eighteen years development carried on by the Sperry Gyroscope Company in co-operation with Army engineers. The rays of these powerful lights have been seen by flyers at distances exceeding 100 miles.



The mechanism of the new searchlights is quite complicated but efficient.

Pan American Airways Has New Service

AN INTERNATIONAL air transport service between the west coast of Florida and the Latin American countries served by Pan American Airways has been inaugurated. Tampa was selected as the base of operations and so pleased was the city with this service that it provided completely equipped operating facilities including ramp, float, pier, stores building and terminal station.

Plans at present call for a tri-weekly schedule using twin motored Commodore flying boats, similar to those now used on the West Indies and South American runs. These big airliners carrying twenty passengers, mail, baggage and express, will make the Havana trip in less than four hours, returning to Tampa the same afternoon.

At Havana connection is made with the trunk routes of Pan American System to the West Indies, Central and South America.

This service is in the nature of a trial venture. Should sufficient traffic be developed to justify major operations, the city of Tampa plans to construct a great marine airdrome which may make Tampa a leading international air transport terminal.

Trapping the Mosquitoes

THE 18th Composite Wing Headquarters at Ft. Shafter, "The Hawaiians," has gone to war. But instead of carrying bombs the aviators trail big traps on their planes to snare their enemies, which are mosquitoes.

The planes are flown over the mountains of Oahu, and from the catches the Hawaiian Board of Health is learning what insects reach the Honolulu area from the windward side of the island. The theory is that many insects cross over the mountains into Honolulu, and if this is borne out, suitable measures will be taken to exterminate them.

We May Have a Big Metal-Clad Ship

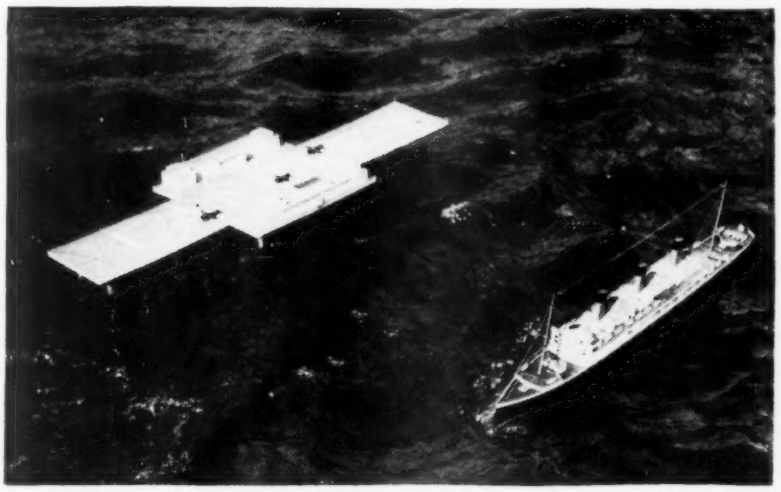
THE "flying tin can" may soon be a regular part of U. S. Navy's flying fleet.

For four years, the Navy has had in actual service an egg-shaped craft 150 feet long and 64 feet high, the airship ZMC, officially, but unofficially the "flying tin can," because her outer cover is made of metal instead of the usual airship fabric.

Rear Admiral Ernest J. King, chief of the Naval Aeronautics bureau, says that he will soon ask Congress for an appropriation of $3,500,000 to construct a metal clad ship as big as the Los Angeles for use as a training ship.

"If I had to choose between a sister ship to the Macon and a metal-clad," says Rear Admiral King, "I think now I'd take the metal-clad. We have done about all we can with a fabric-covered dirigible."

Funds Allocated for Atlantic Ocean Airway



A realistic model of the proposed floating islands which shows the size of the island in respect to that of an ocean liner. Each unit is estimated at $6,000,000 or a total of $30,000,000 for the entire airway.

A STUDY, with definite experimentations for an airway across the Atlantic Ocean on the 39th parallel of latitude, composed of floating islands at not less than 500-mile intervals, is to be financed and owned by the United States Government and established and operated by the Aeronautics Branch of the Department of Commerce.

The Department has received word that the Public Works Administration has allocated funds to initiate work on the project, subject to the approval of the State Department and the President.

Before construction work on the Atlantic airway is started, a one-fourth section of one floating platform will be built at a cost of about $1,500,000 and thoroughly service-tested before the commitment is made for a full unit estimated to cost about $6,000,000. It is estimated that about four months will be required to build the demonstration section. The entire airway, after its feasibility has been determined, will cost $30,000,000 and about 80 per cent of the total will be for labor. This would give employment to 10,000 men for two years.

Studies conducted by the Department's aeronautical experts show that an airway marked out by these floating islands will assure efficient, safe, dependable and profitable 24-hour mail, passenger and express airplane service between the principal cities of the Atlantic seaboard and western European capitals, Secretary Roper said. The landing facilities of the Atlantic airway will be made available to any commercial aviation company or individual of any country on equal toll schedules. These toll charges, it is estimated, will more than pay the operating expenses of the floating islands.

After a thorough study, it was concluded that Federal operation of an ocean airway would be consistent with the Government's long standing policy of providing aid to both air and marine navigation. It was recommended that Public Works funds be provided to build an experimental base and that the project be carried out by the Aeronautics Branch of the Department, in much the same manner as it now provides national emergency landing fields throughout the United States. This recommendation was accepted, and if the Atlantic airway is established, it will be as an extension of the Federal Airways System.

The development of the airway will follow the Armstrong Seadrome plan by establishing floating islands or "seadromes" at intervals along the so-called southern route, via the Azores. This type of seadrome is 1,250 feet long, remains motionless in heavy seas, is anchored and can be equipped with aids to air navigation, accommodations for stopovers and facilities for emergencies.

The landing platform is 100 feet above sealevel and the buoyancy tank counter weights are 200 feet below the surface and in still water. However, it has not been definitely determined whether the number, size and spacing of the seadromes as now considered, will be carried out if the entire airway is to be built. The rapid development of the airplane may eventually change the final plans for the technical layout of the seadromes.

It is still a question as to how such platforms will withstand the heavy storms on the Atlantic and the thundering waves that will, sooner or later, pound upon it.

Sinking the buoyance tanks to 200 feet, or below the surface disturbances on the water will provide a steady platform, undoubtedly, but at the same time will subject it to greater stresses on the superstructure since there is greater relative motion between the waves and the platform.

Inside the Douglas Transport

This bi-motor 12-passenger airliner is the latest word in commercial aviation. In it is combined the experience of the Douglas engineers and the Transcontinental and Western Air officials.

WHEN the Douglas "Airliner" was first conceived, elaborate performance calculations were made to determine its characteristics, and from this investigation the major dimensions were determined and the wind tunnel model was constructed.

This model was 7 ft. 9 inches in span, being 1/11th scale, and was tested in the 10 ft. tunnel of the Guggenheim Aeronautical Laboratory at California Institute of Technology. Three types of wings were tested in order to select the best variation. The nacelles and engine cowling were investigated in great detail and a final solution reached which decreased the overall drag of the engine installation to one-half of its original value and also caused a minimum of disturbance of the aerodynamic characteristics of the wing by the nacelles.

The tail surfaces were tested with the elevator free and with it fixed, this being probably the first time that an elevator free investigation had been carried out on a complete airplane model. The effect of control surface tabs was investigated, both on the elevator and on the rudder.

Several types of aileron and six variations of high-lift devices were investigated on the model. The design was guided by the wind-tunnel test and changes suggested by the tests were incorporated in the model and re-tested until a final maximum was obtained. In all, the wind-tunnel investigation ran to 200 tests and covered a period of three months.

A paper presenting an abstract of the most important of these tests was given before a joint meeting of the S.A.E. and the A.S.M.E. by Dr. A. L. Klein of the California Institute of Technology Laboratory on July 1, 1933.

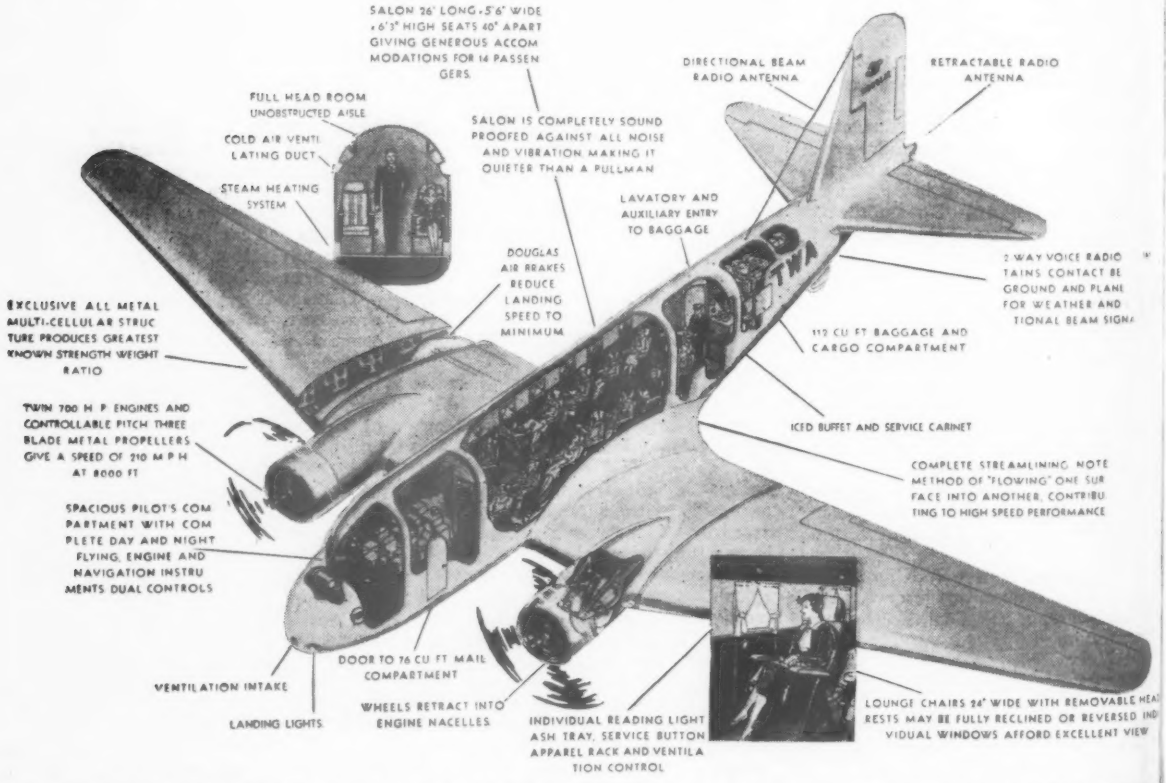
As a result of these tests, the cruising and maximum speeds have been increased nearly 25 m.p.h., and the landing speeds have been decreased 5 m.p.h., giving a total increase in speed range of 30 m.p.h. High lift devices have been so chosen and located that, with these devices in use, the airplane may be flown under complete control with the normal type control surfaces. Stability has been adjusted to provide the desired degree for cruising flight, with a likewise desired lower degree near the stall, thus making an airplane that is easily handled in the cruising attitude and also easily controlled near the stall. These various developments enable the airplane to carry heavy pay loads common to larger craft at high speeds and with a degree of control common to smaller, high performance airplanes.

Responsibility for the design of the Douglas "Airliner" includes H. H. Wetzel, Vice President; J. H. Kindelberger, Chief Engineer; A. E. Raymond, Asst. Chief Engineer; and F. W. Herman, Project Engineer—all of the Douglas Company, who have worked in close collaboration with the T.W.A. management.

This plane is bi-motored with two Wright "Cyclone" F-3 engines, having a gear ratio of 11:16. Each engine develops 710 h.p. at an altitude of 8,000 feet, giving a top speed of 210 m.p.h.

Regarding the structural details, it is interesting to note that the entire structure has been constructed of the new 24S alloy developed by the Aluminum Company of America. The particular material used is largely 24SRT

(*Continued on page* 88)


SALON 26' LONG · 5'6" WIDE · 6'3" HIGH SEATS 40" APART GIVING GENEROUS ACCOMMODATIONS FOR 14 PASSENGERS
FULL HEAD ROOM UNOBSTRUCTED AISLE
COLD AIR VENTILATING DUCT
STEAM HEATING SYSTEM
SALON IS COMPLETELY SOUND PROOFED AGAINST ALL NOISE AND VIBRATION MAKING IT QUIETER THAN A PULLMAN
DIRECTIONAL BEAM RADIO ANTENNA
RETRACTABLE RADIO ANTENNA
LAVATORY AND AUXILIARY ENTRY TO BAGGAGE
DOUGLAS AIR BRAKES REDUCE LANDING SPEED TO MINIMUM
2 WAY VOICE RADIO TAINS CONTACT BE GROUND AND PLANE FOR WEATHER AND TIONAL BEAM SIGNA
EXCLUSIVE ALL METAL MULTI-CELLULAR STRUCTURE PRODUCES GREATEST KNOWN STRENGTH WEIGHT RATIO
112 CU FT BAGGAGE AND CARGO COMPARTMENT
TWIN 700 H P ENGINES AND CONTROLLABLE PITCH THREE BLADE METAL PROPELLERS GIVE A SPEED OF 210 M P H AT 8000 FT
ICED BUFFET AND SERVICE CABINET
COMPLETE STREAMLINING NOTE METHOD OF "FLOWING" ONE SURFACE INTO ANOTHER, CONTRIBUTING TO HIGH SPEED PERFORMANCE
SPACIOUS PILOT'S COMPARTMENT WITH COMPLETE DAY AND NIGHT FLYING, ENGINE AND NAVIGATION INSTRUMENTS DUAL CONTROLS
DOOR TO 76 CU FT MAIL COMPARTMENT
VENTILATION INTAKE
LANDING LIGHTS
WHEELS RETRACT INTO ENGINE NACELLES
INDIVIDUAL READING LIGHT ASH TRAY, SERVICE BUTTON APPAREL RACK AND VENTILATION CONTROL
LOUNGE CHAIRS 24" WIDE WITH REMOVABLE HEAD RESTS MAY BE FULLY RECLINED OR REVERSED INDIVIDUAL WINDOWS AFFORD EXCELLENT VIEW

Phantom view of the Douglas bi-motor low-wing airliner now in service on the airways of the Transcontinental and Western Air (TWA). Note that the interior arrangements are somewhat different from previous ships of this type. This gives greater seating capacity.

The Douglas DC-1, Luxury Airliner of TWA

The new all-metal, low-wing Douglas transport in flight over the coast-to-coast route of Transcontinental & Western Air Inc. Powered with two 700 h. p. engines.

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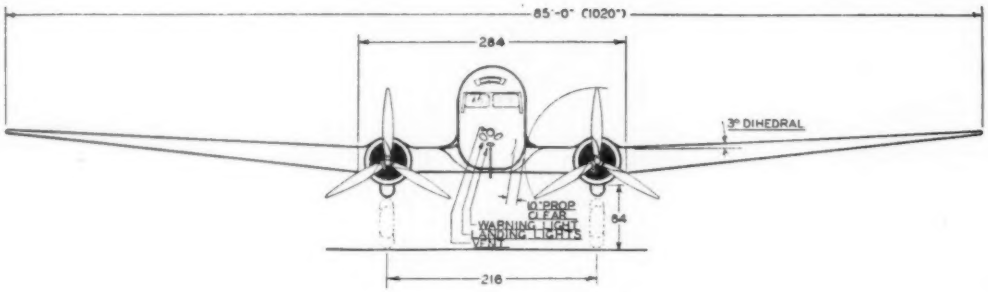
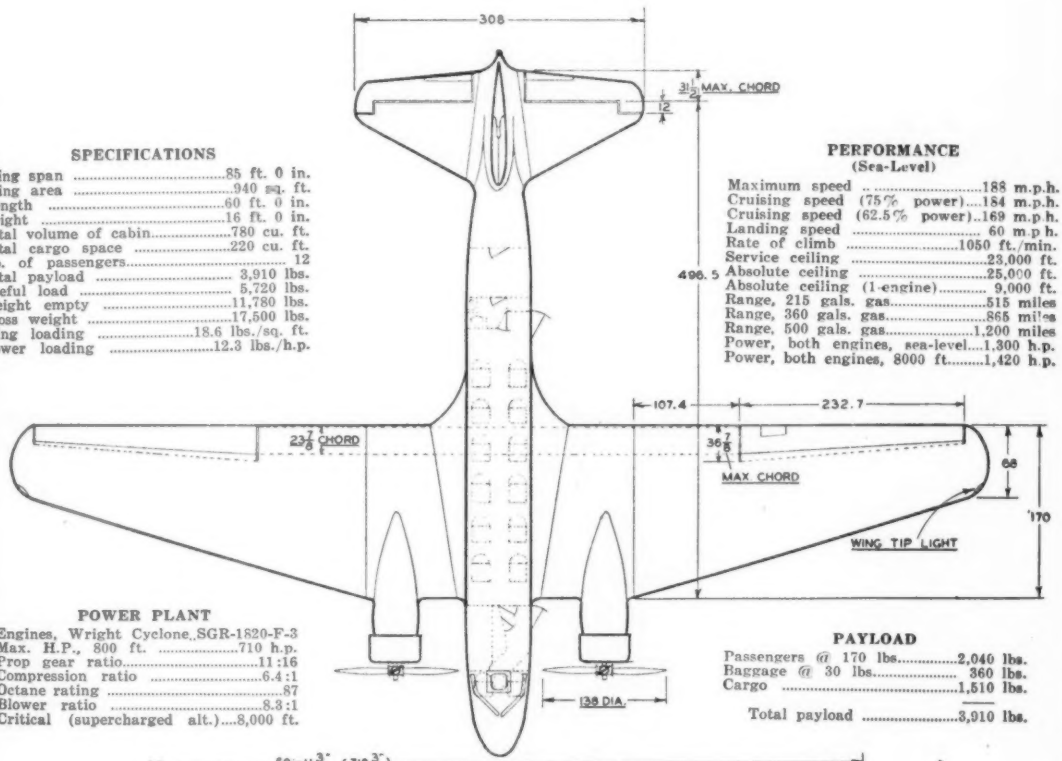
DEPARTMENT OF TECHNOLOGY

Drawings of the Douglas Transport

Three-view dimensioned drawings of the latest Douglas low-wing bi-motored monoplane now in service on the Transcontinental and Western Air lines. This ship can carry 12 passengers and a crew of three together with 1,870 pounds of cargo and baggage.





SPECIFICATIONS

Wing span	85 ft. 0 in.
Wing area	940 sq. ft.
Length	60 ft. 0 in.
Height	16 ft. 0 in.
Total volume of cabin	780 cu. ft.
Total cargo space	220 cu. ft.
No. of passengers	12
Total payload	3,910 lbs.
Useful load	5,720 lbs.
Weight empty	11,780 lbs.
Gross weight	17,500 lbs.
Wing loading	18.6 lbs./sq. ft.
Power loading	12.3 lbs./h.p.

PERFORMANCE
(Sea-Level)

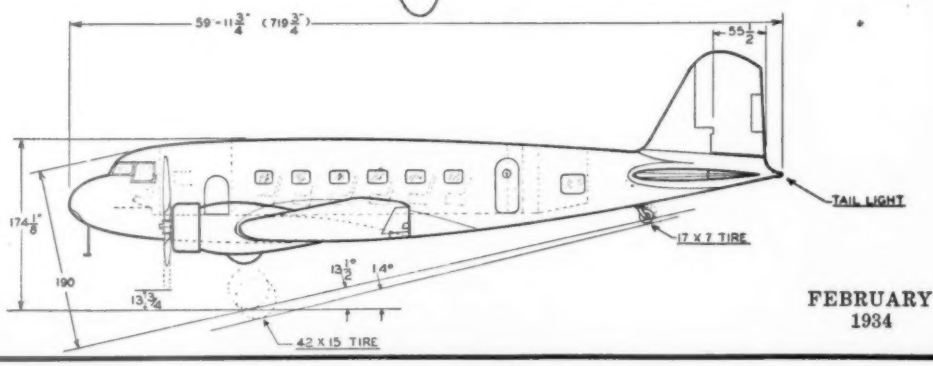
Maximum speed	188 m.p.h.
Cruising speed (75% power)	184 m.p.h.
Cruising speed (62.5% power)	169 m.p.h.
Landing speed	60 m.p.h.
Rate of climb	1050 ft./min.
Service ceiling	23,000 ft.
Absolute ceiling	25,000 ft.
Absolute ceiling (1-engine)	9,000 ft.
Range, 215 gals. gas	515 miles
Range, 360 gals. gas	865 miles
Range, 500 gals. gas	1,200 miles
Power, both engines, sea-level	1,300 h.p.
Power, both engines, 8000 ft.	1,420 h.p.

POWER PLANT

Engines, Wright Cyclone, SGR-1820-F-3	
Max. H.P., 800 ft.	710 h.p.
Prop gear ratio	11:16
Compression ratio	6.4:1
Octane rating	87
Blower ratio	8.3:1
Critical (supercharged alt.)	8,000 ft.

PAYLOAD

Passengers @ 170 lbs.	2,040 lbs.
Baggage @ 30 lbs.	360 lbs.
Cargo	1,510 lbs.
Total payload	3,910 lbs.



Inside the Douglas Transport

(*Continued from page 86*)

Alclad. The strength of this material, particularly the yield point, is appreciably greater than the alloys formerly in use.

The 85 ft. 0 inch span wing is of cellular multiweb construction, and is tapered in plan form and thickness. The center portion of the wing is integral with the fuselage and serves as a mounting for the nacelles and retractable chassis. The outer wing panels are remountable by means of a flanged bolt joint.

Both the vertical fin and the horizontal stabilizer are fixed in position, trim being obtained by means of tabs in the rudder and elevators. The empennage lines are particularly clean and with low drag expanding fillets at the connection of surfaces and body terminating in a cone which carries a navigation light.

The retractable landing gear is operated by a single hydraulic mechanism. Retraction is accomplished in 25 seconds and lowering in 20 seconds, by means of a pump which may be operated by either pilot or co-pilot. The landing gear is counterbalanced, thus permitting it to be operated easily by manual power and avoiding the complications incident to electrical drive. Hydraulic brakes are used which may be applied by either the pilot or co-pilot with a differential control operating through the rudder pedals. The chassis wheels retract upward and forward into the nacelles.

In the retracted position, the axles rest in sockets attached to a main nacelle bulkhead, and, in the event of emergency, the plane may be safely landed on its wheels in the retracted position with no damage except to the propeller tips. Since the wheels in retracted position are several feet ahead of the c. g. of the airplane, there is no tendency to nose over during such a landing. This has been demonstrated by an actual test. The brakes are also operable with the wheels retracted.

The engine nacelles are monocoque except for the engine mount itself, which is welded steel tubing. The engine mount and all items forward of the firewall, including the complete oil system and engine cowling, is quickly detachable and interchangeable right and left. Removal is facilitated by grouping all connections at the firewall and by the use of quickly detachable plugs for all electrical connections.

Exhaust collector ring outlets are below the wing, thus shielding the cabin from the noise and glare of escaping exhaust gases. The carbureter air intake pre-heater, which has a capacity sufficient to prevent icing of the carbureter during the coldest weather, is fitted with a valve controllable from the cockpit and a thermometer located in the cockpit. Direct electric starters with shielded booster coil are used.

The passengers are provided with ample space in the Douglas Airliner, comfortable seats, a wide aisle and ample head-room. The entire cabin is adequately soundproofed.

Hamilton Standard, controllable pitch, three-bladed propellers are standard equipment. Pressure fire extinguisher system serves both engines with selector valve in the cockpit. Fuel is carried in two main tanks of 180 gallons each, and two auxiliary tanks of 70 gallons each, mounted in the wing section on either side of the fuselage. The main tanks are fitted with dump valves which may be opened and closed by controls in the pilot's cockpit.

The pilot's compartment is roomy and has been carefully designed for comfort and to eliminate reflections and glare. The compartment is normally reached through a corridor from the passenger cabin but an emergency exit is provided in the roof together with a folding hatch for observation and navigation. For the latter purpose, a drift indicator and chart board are also provided. Pilots' seats are adjustable vertically and as to tilt and are very comfortably upholstered, including arm rests. Movable panel windows with shatter-proof glass form the windshield and are so arranged that they may be cleaned externally while in flight. Excellent vision is possible from the cockpit, due to its position in the extreme forward portion of the fuselage, well ahead of the wings.

The passengers' seats are of Douglas design, specially constructed and fully adjustable. They are mounted in rubber to minimize vibration and allow for individual adjustment of seat bottom and seat back. The back is reversible, allowing passengers to face either direction.

The floor of the cabin passes over the top of the wing rather than through it. There are, therefore, no structural obstructions in the aisle, while the six foot three inch clearance throughout the cabin insures sufficient headroom. Passengers are seated high enough above the wing to provide excellent vision from all seats. Individual reading lights, ash-trays, literature pockets, etc., have been provided for each passenger, and a mesh hat-rack is installed along each side of the cabin above the windows, with a hand rail for the benefit of passengers passing up and down the aisle.

The cabin has been entirely soundproofed under the direction of engineers of the Sperry Gyroscope Company, and has a sound level at cruising speed below 70 decibels, thus comparing most favorably with Pullman car ratings. A highly satisfactory ventilating and steam heating system has been worked out in connection with the sound-proofing development. Controlled ventilation is effected by admitting air through a vent in the nose of the fuselage and transmitting it by ducts to the cockpit, cabin and lavatory. A thermostat insures that the temperature in the cabin will be maintained at 70° F. with outside air temperature as low as 20 degrees below zero.

Entrance to the cabin is by means of a door on the left side of the fuselage. Aft of this door is located the buffet, which is complete with ice-box and full facilities for serving meals while in flight.

Dual controls are of the individual wheel type with pedal foot controls. The control column supporting the wheel passes between the pilot's leg and the skin of the fuselage and does not obstruct either member of the crew in getting into or out of his seat. Instrument equipment is most complete and of the latest design, while the grouping facilitates easy inspection and service. The board itself is mounted on flexible rubber bushings.

END.

A New Stratosphere Record

by TYRRELL KRUM

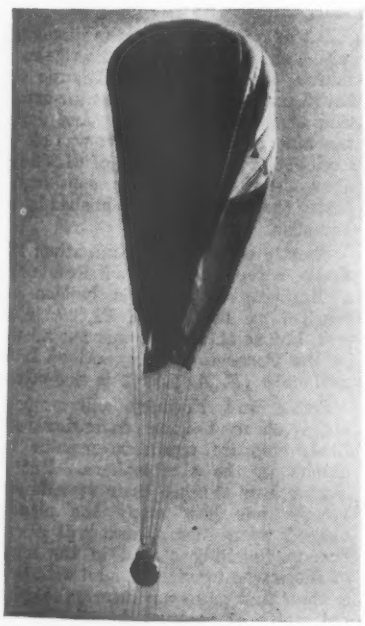
A detailed account of the successful stratospheric flight of Lieut. Commander Settle and Major Chester Fordney, written by a representative of the Union Carbide and Carbon Corporation, makers of the hydrogen gas used in the balloon.

AERONAUTICAL history has recorded in unfading words the story of the spectacular ascension of Navy Lieutenant-Commander T. G. W. Settle and Major Chester L. Fordney, U. S. Marine Corps Reserve, nearly twelve miles above the earth in a scientific exploration of the stratosphere with their famous "A Century of Progress" balloon.

The two gallant officers have added to the long list of records in possession of the United States that of having officially risen higher into the heavens than any other living men. They shattered the official 52,000-foot mark of August Piccard by ascending to 61,236 feet.

Vast stores of knowledge concerning conditions prevailing in that deep-blue quiet mystery-land far out overhead have been placed at the disposal of airmen and aircraft engineers to ponder over as they plunge further into the perfection of aircraft for future generations. And to the whole field of basic and applied science has been opened up a new wide avenue down which scientists and scholars may wander in the search for the answer to the puzzling questions pertaining to atomic and cosmic ray research.

Men and women throughout the world listened with fired imaginations to the radio broadcasts from the tiny gondola miles above the earth as the two intrepid pioneers in stratosphere ballooning floated through the skies from the Goodyear-Zeppelin Dock in Akron to the tide-swept marshlands of southern New Jersey.



—*Courtesy Chicago Daily Newsreel.*

Up she goes, an excellent snapshot taken an instant after the balloon left the earth at Akron.

—*Courtesy Chicago Daily Newsreel.*

Well, here are the victors in a hilarious mood after their record breaking trip. At the left is Major Chester L. Fordney, U. S. Marine Corps Reserve. At the right is Lieut. Commander T. G. W. Settle, U. S. Navy.

But back of all the pomp of official receptions and the plaudits of an admiring nation there is another phase of the history-making flight of which few are familiar. It is a story of planning and preparing, of hoping and waiting and heart-breaking disappointments and delays the like of which would have bowed down most men.

It is the living symbol of that axiom of aeronautics—"stand by until conditions are right and then shoot the works."

The story of the first ill-fated attempt of Commander Settle to take-off from Soldier Field at A Century of Progress as one of the outstanding scientific contributions of the great world's fair is known to all. Amid the blare of brass bands and the plaudits of thousands, the great balloon was inflated with hydrogen, floated away majestically into the summer night. Fifteen minutes later it was a shrunken mass of lifeless fabric stretched across the steel rails of a train yard at Fourteenth street and the Drainage canal —three miles from the starting point. All the elaborate plans of several month's preparations had been defeated by a faulty control valve which had failed to function.

Undaunted by the untimely frustration of his dreams, Commander Settle immediately began making plans for a second ascension. Sponsors of the flight patted him on the back and told him they were with him to the limit. Officials of Union Carbide and Carbon Corporation assured him of their unflinching co-operation and again placed at his disposal another allotment of precious hydrogen to replace that which had gone off into space when he pulled his rip-cord and settled back to earth.

The balloon, which was damaged severely by souvenir-hunters' vandalism, was repaired, oxy-acetylene welding quickly restored the bottom of the gondola, the scientific instruments were removed and rechecked, a fresh supply of Eveready batteries was installed in the radio and cosmic ray apparatus, and everything was placed in shipshape order at the exposition grounds for another try.

It was decided that the ascension should be made from the Goodyear airport within the Fair grounds with but a few spectators in contrast to the ceremony at Soldier Field at which more than 75,000 persons waited long into the night to see the inspiring spectacle. Major Fordney, who in addition to being one of America's outstanding fighting men wherever Uncle Sam's marines have swung into action, whose avocation is physics and mathematics,

was detailed to accompany Commander Settle.

Everything was put in readiness and the two men, casting a weary eye at the calendar as Indian Summer swung into early Fall, waited patiently for a break in the sequence of low-pressure climatic conditions and high-velocity winds which prevail in the famous Windy City. From mid-day until late at night Commander Settle pondered over weather reports and charts in the United States weather bureau high up in the gilded dome of Chicago's Federal Building.

Uncle Sam and the Dominion of Canada placed at his disposal unequalled facilities for obtaining accurate data on prevailing winds and anticipated pressure areas throughout the great northwest, in which most of the shifting good and bad weather originates. Knowing from long experience that it would be exceedingly perilous to attempt to inflate the balloon in a wind of more than five miles velocity, Settle was dismayed as day by day flitted past and the wind failed to abate to less than ten miles velocity.

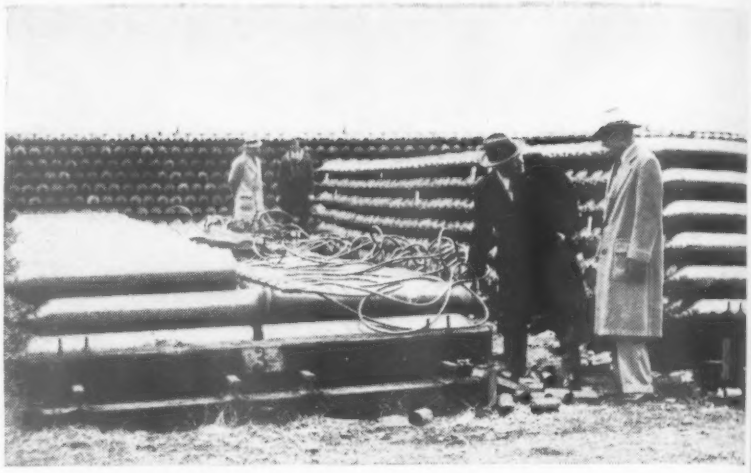
One blustery morning, but a few days before the Fair closed on November 12th, it appeared that the break had finally come. Reports racing in from the Canadian Rockies indicated that an exceptional high-pressure area was moving into the middle-west and would likely result in a diminution of the wind velocity to the desired point.

"We'll stand-by for the four o'clock reports," Settle stated shortly before noon. "Looks like we might have a chance tomorrow morning." When the mid-afternoon wires trickled in conditions still appeared favorable. The Commander ordered Fordney to collect a ground crew for an operation the next morning. And then departed for his hotel to snatch a few hours sleep. At midnight he was again at the weather bureau scanning reports. After pondering for some time, Settle telephoned the Goodyear airport.

"Looks like the wind will go down before sun-up," he called over the wires. "Have the men lay out the balloon and stand-by. I'll be there at three o'clock." A few hours later he was racing for the airport.

Half a hundred sleepy-eyed members of the ground crew, a detachment of marines, and a corps of newspaper men and photographers comprised the group gathered around the bag laid out on the gravelled landing field. Forty-eight hours later the curtain was to be rung down on Chicago's great exposition of which the stratosphere ascension was to be one of the outstanding features.

An hour later, the first thin gleams of the morning sun sneaked up from far out across Lake Michigan and still the stiff wind had failed to subside. Settle and Fordney stood alone amid a jumbled pile of stones at the water's edge and gazed out across the shimmering lake. Their hands clinched deep in their pockets and their tousled heads



Just a few of the 750 cylinders of hydrogen gas used for inflating the bag of the stratospheric balloon. The cylinders are connected to a manifold that leads to the balloon.

bared to the stiff breeze, they stood silently facing the inevitable futility of a gallant battle waged against the elements.

"Well, Mike," Settle spoke softly, "it's been a long wait, and it looks like we're licked. We might chance it but there aren't enough men in Chicago to hold that bag on the ground in the face of this blow during the time necessary to pour 750 cylinders of hydrogen inside. So I guess we'll have to sound 'secure'."

The two men scrambled back to where a group of newspaper men were waiting and Settle made the announcement. Slowly he explained to the news-hawks his reasons. Intently the men of the press, many of them veterans of hundreds of assignments in all corners of the globe, listened. When the Commander had finished applause came forth. "That's one of the most courageous things you've ever done, Tex, much better than making a foolhardy attempt at something you know shouldn't be," was the expression voiced by one of the group.

Before night had fallen on that last day of the world's fair, Commander Settle and Major Fordney had conferred with the sponsors of the flight for a second time and had again been given unreserved backing for an ascension from the mammoth Goodyear-Zeppelin dirigible dock in Akron, Ohio, the birthplace of the Akron and the Macon and temporary lodging-place of the Graf Zeppelin during the trip to A Century of Progress.

Immediately, the gondola was loaded on a truck and sent on its way. The balloon envelope was rolled up again and with the rigging and equipment shipped to the Ohio city. A ground crew of experts in gas operations of Union Carbide and Carbon Corporation worked in a blinding snow storm until after midnight detaching the hydrogen manifolds from the cylinders and loading them for the long trip by truck. Major Fordney and Commander Settle gathered together their personal effects and started off into the storm-swept night for Akron.

Two days later the balloon was fully inflated in the giant air-dock and the ground crew ordered to stand-by for the ascension. And, shortly after sunrise on the morning of November 20th, the huge balloon with the gondola riding on a "dollie" beneath was towed out into the morning sunshine. It was a perfect day for a take-off; a wind of about 5 miles was blowing across the field and the fleecy clouds high above were scattering as the order was given to "weigh-off."

The two officers bade farewell to their wives and friends, waved goodbye to the small group of persons assembled around the field and the Commander gave the order to release the lines attached to the gondola.

It was a far call from the wind-swept lake-front in Chicago to the tide-swept marsh far out on the Atlantic seaboard but it was there that the expedition ended that evening. And during the nine hours the balloon was off the ground it reached a peak of 61,236 feet above the earth, being considerably better than the mark established by the Piccards.

Shortly before this second attempt by Settle, a report came from Russia that a Russian stratospheric balloon had reached an altitude of 62,000 (plus) feet, but as this claim was not allowed by the Federation Aeronautique Internationale (F. A. I.), it is not official.

Settle and Fordney will probably make other balloon ascensions and likely venture again to greater triumphs in the stratosphere. But no matter how shining their records may become nor how many the plaudits heaped upon them, there will always remain indelibly etched in the minds of those who were associated with them in their first great adventure, the splendid motto of genuine Americanism as voiced by the "Skipper Settle"—"No question is ever settled until it is settled right."

END.

A Farmer Hog-Tied the Shenandoah

FARMER ERNEST NICHOLS actually tied down the drifting nose of the giant dirigible Shenandoah after it had broken in two in 1925. He can best tell in his own words what happened on that eventful night.

"Well, sir, I can show you better than I can tell you. I was in the house when my neighbor called up on the telephone and said an airship was headed for my house and I had better stop it. I ran out and here it came right through our orchard, headed straight for the house. After drifting all that way (12 miles) after it broke up, it was getting pretty close to the ground. It was sure enough coming right toward my house.

"I saw my eldest boy—I have six boys and one girl—sticking his head out of the upstairs window. I knew I had to stop that thing or the house would be smashed and my kids would be killed. Then, too, I heard the fellows up there yelling 'Grab hold. Grab hold. Turn her south.' So I grabbed hold of the cable that was hanging down and drew it around a fence post. The post snapped right off.

"I grabbed the cable again and threw it around an old maple stump. The stump had two prongs on it, and I thought sure it would hold, but it didn't. By that time the nose was so close to the ground that the underside had me backed up against the fence, and I had to run. It was headed away from the house then, but it knocked off the top of the shed and the wheel on the wall and then bowled over the grape arbor.

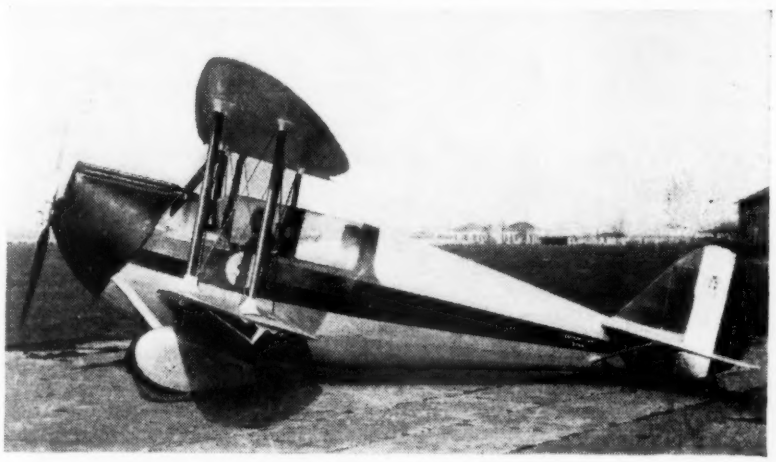
"I kept following it and finally threw the cable around a tree. All that time I didn't know what the thing was. I didn't know it was so big. Why it's over 350 feet long. Soon my kids came running out and we helped to tie it up. Even then it didn't stay where it was until the men borrowed my shot gun and punctured the gas bags."

Flock of Canaries Fly South

"TWEET! Tweet!" "All Aboard!" One dozen canary birds went for a long flight southward in their gilded cage. They chirped a goodbye to Broadway, sped to Newark Airport and boarded the regular morning plane of Eastern Air Transport for Atlanta, Ga., 803 miles distant. Cage and all, they traveled as General Air Express, prepaid.

The airliner's flying hostess had them in full charge on the flight. It is the first canary bird shipment on record in this country, and is being made with the idea of saving some of the little singers' lives. Canaries suffer a high mortality rate when winter shipping is necessary, and it is believed that this loss will be eliminated by forwarding them in heated passenger airliners. The time needed for the journey will be shortened by approximately two-thirds.

A New Caproni Sportplane of Unusual Design



A side view of the "deep-breasted" Caproni "125" sport-type biplane with the cockpits enclosed ready for flight. Deep fuselage will evidently be as popular as thick wing sections in the near future.

SIGNOR CAPRONI certainly has original ideas. He has just built a new light biplane known as the "Caproni 125" which has attracted a great deal of attention in Italy because of its peculiar fuselage form. The fuselage greatly resembles the body of a pouter pigeon being deep and round in front and tapering toward the rear.

To the surprise of European experts, this ship shows a most excellent performance. It is a two-seater of composite construction, covered with plywood and fabric. It is powered with a 125 h.p. in-line air-cooled Colombo S. 63 engine which gives it a top speed of 134 m.p.h. The landing speed is only 36 m.p.h. (60 km. per hour) which is quite a surprising speed range.

The biplane wings are of elliptical form with stagger and a slight dihedral. The span of the standard wing is 29 feet (8.85 meters), but a larger wing can also be supplied equipped with Handley-Page slots for lower speeds or when pontoons are supplied. The ailerons are carried only on the lower wing.

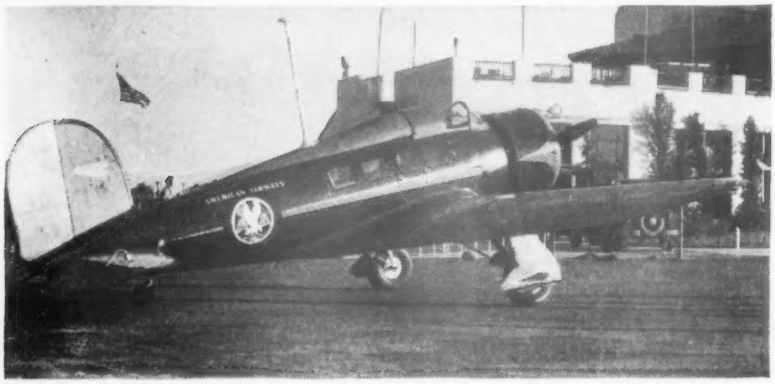
A chromium steel welded tube fuselage is standard, stiffened by steel cross-tubes. It is of oval section, the engine being mounted in front on elastic connections to reduce the effects of vibration. Fuel and oil tanks, of Electron, are mounted in the fuselage which give a cruising duration of 5 hours. The roomy fuselage, however, makes it possible to install larger tanks so that the maximum cruising range can be brought up to 1,500 miles. The weight, fully loaded under standard conditions is only 1,790 pounds.

Close inspection will reveal that the fuselage is exceptionally clean and free from projections or cavities that would ordinarily interfere with the air stream and cause resistance. Further, the outlines of the fuselage present gentle sweeping curves at all points without sudden changes in section which undoubtedly accounts for the speed of the plane.

It would be interesting to discover how well this type of body would work out with a radial air-cooled engine, employing a special cowl for the unsymmetrical fuselage nose.

Three-quarters front view displaying the elliptic aspect of the wings and the peculiar struts employed with the landing gear wheels.

The New Lockheed Orion Shows Her Speed



Externally, she is the same old Orion but with the new Wasp engine and the controllable pitch propeller she's a whole lot faster.

THE history of the Orion makes interesting reading. The first Lockheed Vega made its appearance in 1927; and with its plywood monocoque fuselage, it was the fastest commercial airplane built. In the 1928 National Air Races at Los Angeles, it was the fastest civilian airplane. With Bob Cantwell at the controls, a Wasp-powered Vega averaged 140.3 miles per hour.

Since 1927, approximately 200 Lockheeds have been put into the air. Every one to date (speaking of the fuselage) has come off of the same form. This is true of the Orions just delivered to American Airways. The guaranteed cruising speed of American Airways' Orions was 185 miles per hour. Flight tests at 8600 feet have shown a cruising speed in excess of 200 m.p.h. with a radio mast, and in excess of 206 m.p.h. with a trailing antenna. Principal credit for the superior performance of this year's model perhaps is due to the new Wasp and to the Smith controllable pitch propeller, which, as you know, is capable of numerous settings. The Smith propeller has been adopted as standard equipment on all Lockheed models.

The fundamental design of the Orion has been justified by experience. It is noticeable that all other high-speed transport craft are coming to this same general design—low-wing with retractable landing gear. The fuselage of this year's model has been given an extra six inches in length, and the tail group has been redesigned. The elevator and stabilizer, for example, have a wider span.

To eliminate the possibility of elevator flutter, an elevator balance (or vibration dampener) has been added. A lead weight is suspended from a curved iron attached to the elevator. The weight is centered in the stabilizer when the elevator is in normal position, and only protrudes above or below the stabilizer when the elevator is lowered or raised. As you know, vibrations increase rapidly when speeds above 200 m.p.h. are attained, so some such "vibration dampener" is advisable.

Some of the principal specifications of the Orion are: Type: 7-place, cabin, land monoplane (the American Airways' Orion provide for four passengers, pilot and mail); Engine, P. & W. Wasp S1D1; 500 h.p. at 2200 r.p.m. at 7000 ft.; Length, 27 ft. 10 in.; Span, 42 ft. 9¼ in.; Root chord, 102 in.; Tip chord, 62⅛ in.; Wing area (including ailerons and fuselage), 294.1 sq. ft.; Wing area including ailerons but no fuselage, 262.1 sq. ft.

Airfoil section, root, Clark Y-18; Airfoil section, tip, Clark Y-9.47; Fin area, 11 sq. ft. Rudder area, 12.8 sq. ft.; Stabilizer area, 39 sq. ft.; Elevator area, 23.5 sq. ft.; Aileron area (both sides), 22.4 sq. ft.; Height overall, 9 ft. 8 in.

Landing gear tread, 11 ft. 7 in.; Landing gear, completely retractable within wing.

Gross weight (with passengers), 5400 pounds. Gross weight (mail and baggage only), 5600 pounds. Empty weight, 3325 pounds. Maximum speed at sea-level, 226-230 m.p.h.

Stalling speed, 70 m.p.h. Landing speed, 65 m.p.h. Maximum rate of climb, 1450 ft. per min. Service ceiling, 22,000 ft. Cruising range (with normal fuel load of 132 gals.), 750 miles.

The original Orion was the fastest commercial plane in the world, and the present increase in speed is due to taking advantage of improvements in motors and propellers and adding a few minor refinements, rather than to any radical changes in design.

The Orion represents the remarkable performance possible in the field of single-engined transport planes, a speed that is considerably above that of the twin-engined type or the tri-motors with their heavier loadings.

There is still a diversity of opinion on the advisability of a small high speed plane as against the slower speed multi-engined plane as regarded from the standpoint of economy. Europe tends toward slower speeds and greater passenger carrying capacity while America's opinion leans in the reverse direction.

Dropping a House From a Bomber

WHEN Mr. Judd, Chief Forester of the Territory of Hawaii, decided to build an overnight camp in the Kaipapau Forest Reserve for the use of forest rangers, he was confronted by the prospect of the arduous labor required to take the materials to the chosen site.

It was not an elaborate structure that he planned, only a little one room hut with a lean-to, to be built of logs and roofed with sheet iron. Altogether, the materials required weighed only 1,200 pounds or so.

But consideration of the site chosen for the building will reveal just why the transportation of this nominal weight of materials presented such a forbidding task. The spot selected was on the summit of the Koolau Range about four miles by air from the little village of Hauula. But these four miles are twice that many hours of hard dangerous mountain climbing along high steep cliffs, stung by rain and buffeted by the strong North-east Trade winds that blow almost unceasingly.

The trail winds along over ground eroded and softened by wind and rain and so steep and treacherous that each step must be guarded lest the ground give way beneath the traveller and hurl him into the depths of the chasm below. Not even the sure-footed pack mule can traverse that trail.

The Army Air Corps, however, solved the problem by offering the use of an Army Bomber to transport the materials by air and drop them at the required place. Accordingly, the galvanized iron for the sides and the roofing, together with the wooden framework members, were cut to convenient lengths and then done up into three bundles and sent to the 23rd Bombardment Squadron at Luke Field for delivery. The forest rangers proceeded to the site unhampered by heavy loads and marked the spot with white cloth panels.

Captain R. Baez, Jr., Squadron Commander and Lieutenant Howard Moore, Squadron Operations Officer, conducted an aerial reconnaissance over the territory and drew up a plan of operations. It was found that the almost vertical cliffs on the Northeast side of the Koolau Range interpose a barrier to the strong trade winds and cause a vertical current of warm, moist air up the side of the mountain range. This current is cooled by the 300-foot ascent, and the moisture is condensed into huge cumulus clouds which form and hover along the summit of the range, usually with no space intervening between clouds and mountain.

Observation disclosed that occasionally rifts occurred in the clouds, and it was decided that by taking advantage of these rifts, a pilot could fly over the panel and drop the bundles. Back at Luke Field an external bomb

(*Concluded on page* 132)

Wild West Aviation Stunts

by WILLIAM L. HOPSON

Thrilling experiences of a barnstorming party on the rugged plains of the west, where men are men and where they collect on an exhibition—once in a while.

THEY say that the most dangerous period in the life of a pilot is between his tenth and one hundredth hours. Most of his foolishness will be over by that time, and if he can survive that I'm-the-best-pilot-in-the-world feeling, his chances of living to a ripe old age are considerably bettered.

But nobody has ever said anything about a chute jumper.

So-o-o-o, as Ed Wynn says, I'm going to step forward with the announcement that most jumpers with five or six jumps to their credit are like the fledgling with twenty or twenty-five hours solo marked in his log book—it's their most dangerous period. Take it from one of the brethren who almost ended his promising young career on two different occasions before he finally got some sense pounded, or rather jolted, into him and stopped trying to be a grandstand hero.

It happened thus: One day, several years ago three of us—Manley Ritchey, pilot, Web Appel, owner and mechanic, and myself—landed in a pasture on the outskirts of a small town in Idaho. As luck would have it, it was Saturday and there was a large crowd of farmers in town. That afternoon everyone came out to the pasture to gawk and to ride. The ship was a converted Jenny with a Curtiss K6 motor. We called her "Luke."

I had now made three jumps, getting nothing for the first, $25 for the second $14.35 for the third which set me down in a river. It ruined my new $19.75 boots which I had bought for the one purpose of letting people know that I was an *airman*—and like the baby who after learning to crawl soon tries to walk, I began to look around for new worlds to conquer.

I soon found them!

Among the crowd who came out to the pasture that afternoon were a couple of cowpunchers, and they were about half pickled. Sure of selling them a ride, I went over. I don't remember exactly how it came about but while I was trying to induce them to part with five dollars apiece for a ten minute ride in Old Luke one of them offered to bet me ten dollars that I couldn't ride his horse.

Of course, I couldn't have stayed in the saddle one minute had the animal so much as broken into a gallop; but to save my face I offered to bet him ten dollars that I could tie his saddle on the turtleback behind the pilot's cockpit and stay in it while Ritchey turned the ship over in a loop.

"Mister," he replied seriously, "you just wait a minute while I go over an' have a talk with some of my friends," and grabbing his pardner by the arm he hurried away. Never will I forget the feeling that hit my stomach a few minutes later when he returned with several men at his heels, all grinning.

Floating down slowly with a stable triangular 'chute is sure a solace after the old top blows open and the plane is at a comfortable distance. But the game is growing old now—so far as the public is concerned.

"We've throwed in a buck apiece," said the puncher, "It'll be worth that much to see you do it. You can use my saddle."

I was sunk and knew it. But I couldn't back out. We went over to where Web and Ritchey were trying to sell a couple of farmers the idea that they should go for an airplane ride and I explained things to them. Web called me several different kinds of a fool, and Ritchey said he reckoned if I was a big enough fool to try it he was a big enough fool to take me up. I agreed to give them half my winnings and we got the saddle and lashed it on with a couple of lariats.

One of the ropes, we ran through the hole in the fork of the saddle and down into the cockpit where we lashed it to a cross member of the fuselage to keep it from slipping backwards. Then, badly scared, I crawled aboard, Web swung the prop on the K6, and after a long run, Richey booted her into the air.

He climbed the ship to about fifteen hundred feet before he got ready to loop it. By that time I had run my left arm in under the ropes running to the cockpit and grasped my left wrist with my right hand. I might fall off but that saddle was coming with me!

Ritchey turned around in the cockpit, grinned at my nod, opened the throttle and stuck the nose of the ship down for a two hundred foot dive. Then I lunged forward against the horn as he brought her up and started over. Everything went swell until the ship got over on her back where she stalled. My body was blocking too much air and the loop was too wide. Old Luke hung on her back for a fraction of a second and then fell straight backwards and down.

Never have I had such a feeling as the one that assailed me as I hung there upside down clinging to that saddle with the ship on top of me. Another two or three seconds and I would have started slipping from the saddle. But the nose dropped down and Ritchey leveled her out, and turned to look at me with a grin. I poked a somewhat shaky hand down toward mother earth. A few minutes later when I crawled out of the saddle to the honking of automobile horns my legs almost buckled beneath my weight. Lesson number one!

We flew into Melba, Ritchey's home town, the next day. It was a little place, but about a week previously, we had put a bunch of home made handbills in all the windows along its one street with the result that every farmer for miles around was out to see us hop passengers. I have seen a lot of money made hopping passengers but never yet have I seen it roll in so fast as it did that afternoon.

Men with their wives and older children actually scuffled for a place in the waiting line. In exactly two hours and thirty-five minutes, we took in two hundred and twenty-five dollars, and that includes fifteen minutes taken out for a parachute jump. A hat passed around had netted me twenty-five dollars and seventy cents.

But, eager as they were to ride, so were they eager to see. We had to fight them away from the spinning propeller. Try as we did we couldn't keep them from driving their cars out a little further and further to get a better view. Since we were working right in front of a long string of vehicles of all sorts, some of them were almost out in the runaway. And the dust was terrible. It rose in sluggish brown clouds that hung almost motionless in the air everytime Ritchey landed or took off. By the time he would taxi down to the end of the runaway and take on a new

load of passengers it would hardly be settled enough for him to see.

There was one ambitious farmer and his blushing violet that I couldn't keep back. Everytime I would get out of sight he'd promptly start the motor on his Ford coupe and pull out to the edge of the runaway again. And I must say that he had a good view while it lasted —but it didn't last long.

Richey had just landed and taxied down to take on another load of passengers when I started down at a dog trot for the third or fourth time to make the thrill-seeking rustic back up his car. I heard the roar of the old K6 as Ritchey gunned her and somehow the closer he got the nearer he sounded to the cars.

I threw a hurried glance back over my shoulder to see Old Luke come plowing down through the dust and heading slightly in toward the line of cars. A fraction too much left rudder! I gave a yell and dove between two cars then wheeled to watch her flash past with Ritchey's goggled face peering over the side of the cockpit. She bellowed down the runaway, the wheels bumped from the ground—CRASH!

Through the dust, I saw the lower left wing crumple into splinters and torn fragments, saw old Luke scoot on her nose for two hundred feet before Ritchey had time to cut the gun, saw the glass in the Ford disappear into a million flying pieces. As I ran toward the ship, I saw two very white faces framed in the windowless coupe with a trickle of blood running down the farmer's neck. Flying glass. But he wasn't seriously injured. As a matter of fact, he was the only one who did get a scratch.

Poor Ritchey! He came out of that cockpit, saw his passengers were all right, and literally blistered the air with profanity.

No one could blame him—for old Luke was indeed a sorry sight. The prop had been reduced to splintered stubs; the landing gear, or what was left of it, showed smashed beneath the wrinkled nose of the fuselage, with both wheels flattened and the tires blown out. The lower left wing was reduced to matchwood and the spars broken in two others; and one of the lower longerons in the nose of the fuselage was broken.

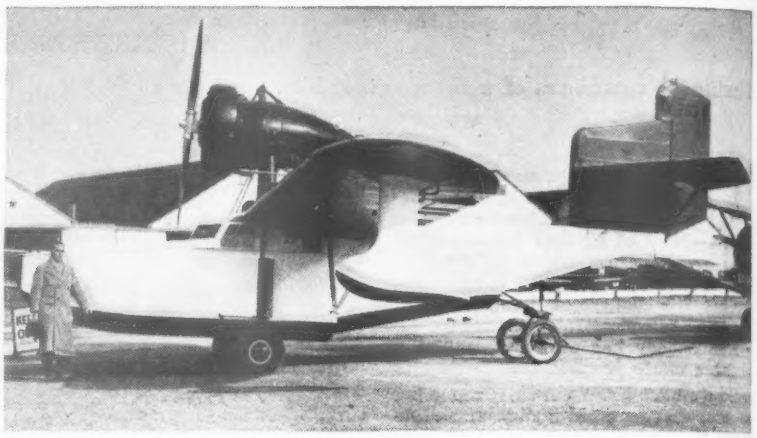
The crackup of old Luke certainly did bring the cobhouse of one very inexperienced, but somewhat mollified, parachute jumper tumbling down. For the last few days I had been laying awake part of the nights trying to figure out how much money I could bank in two or three years at $25 a day. And now . . . Web said that five weeks would see her in the air again. Five weeks! I saw several hundred hypothetical dollars go glimmering.

I had a lot to learn about barnstorming!

We picked up the remains of Luke the next day and brought them home on a truck. And that night Web and

(*Concluded on page* 133)

The High-Speed Loening Amphibian Completed



Grover C. Loening and his new "mystery" amphibian which has been built behind closed doors.

GROVER CLEVELAND LOENING is shown standing beside his latest Amphibian which was completed after several months of secret work. This ship, which contains many new features, is expected to be the fastest commercial amphibian in the world, but in spite of its high top speed, the landing speed is very low.

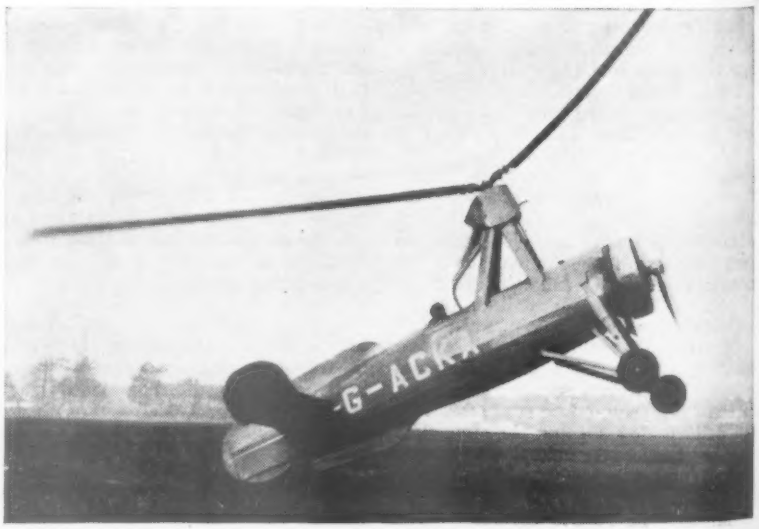
A great deal of attention was paid to the streamlining of the hull and structural parts and it is at this point that the Loening amphibian differs from the majority of this type. It is equipped with split trailing edge flaps, hydraulic wheel brakes and a variable pitch propeller. The conventional Loening tail group has been retained.

The Latest Wingless Autogiro

THE latest type of Autogiro, designed and constructed by Juan Cierva, was given its first test at the Hansworth Airport, England. This Autogiro has no wings and the diameter of the three-bladed rotor is correspondingly increased. In the test shown here, the new Autogiro took off after a run of only ten yards.

Lateral control is now had through the blades of the rotor, varying the relative angles of the blades producing results equivalent to the use of ailerons.

We have no data on the performance, but it would seem logical that this general "cleaning-up" would lead to higher speeds than have hitherto been achieved with the winged type. Speed with an Autogiro, however, is also a function of the rotor characteristics so that the overall improvement may be still restrained to a slight increase in speed. We will be interested in the figures.



The new wingless Autogiro sure displays some take-off. Note the three-bladed rotor.

Roosevelt Student Wins Trophy

Charles May, student flyer holding the Royal York Trophy.

CHARLES MAY, a student at Roosevelt Field and now taking a transport pilot's course at that school, won the supreme student flyer's trophy for 1933.

This fall, he flew to Toronto, Canada, from Roosevelt Field, solo, and while in Toronto attended the Toronto Flying Club Air Meet on Labor day where he won the Royal York Trophy. This trophy is given each year to the best all-around student flyer and therefore is most highly esteemed by the student pilot world.

May is working, at the present time, for Amphibians, Inc., at Roosevelt Field while completing his transport pilot's course.

Colloidal Graphite Lubrication

WHEN plain oil is employed for the lubrication of aviation engines, great difficulty is experienced in making the oil stand up under the high temperatures, pressures and speeds common to aviation engines. The unassisted oil burns off rapidly and the lubrication is therefore interfered with.

However, by the use of the exceedingly finely pulverized graphite, known as "colloidal graphite," a new lubricant by the name of "Grafoil" produces superior lubrication under high duty requirements. The colloidal graphite, used in Grafoil, fills the microscopic pores in iron or steel and therefore produces a satin smooth surface.

Further, Grafoil is provided with a gum solvent that breaks down the carbon that otherwise would adhere to the valves and the interior of the cylinder.

Details of the Curtiss F11C-2 "Goshawk"

(See Front Cover Drawing)

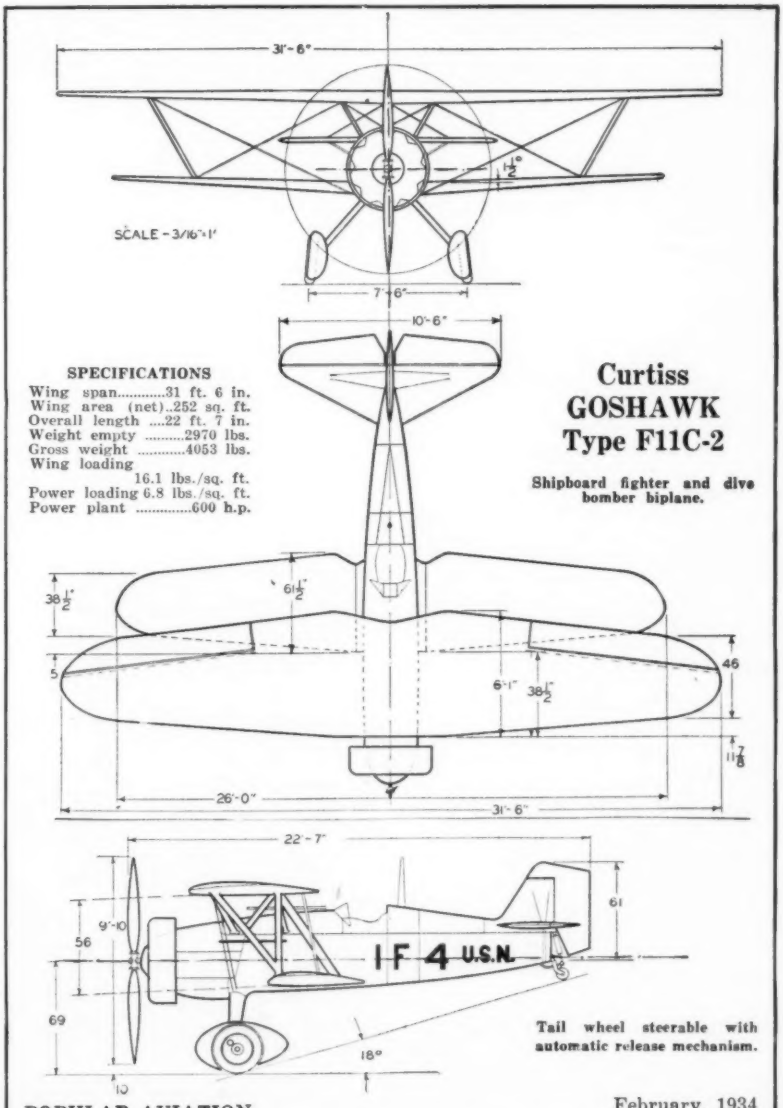
THE Curtiss "Goshawk," Type F11C-2, is one of the recent shipboard fighters and bomb divers employed by the U. S. Navy. It is a single-seat biplane with staggered overhung wings, the latter built up of wood spars and ribs, fabric covered.

Ailerons are applied to the upper wings only and are fabric covered duralumin construction. They are operated by positive push-pull rods. On the contrary, the elevator and rudder are operated through cables from the manual controls in the cockpit, the surfaces of the tail-group being metal framed and fabric covered.

One Wright "Cyclone" engine, Type R-1820 F-2, is installed within a Curtiss drag-ring. This 9-cylinder engine is rated at 600 h.p., 1850 r.p.m. at 8,000 feet altitude. The main fuel tanks, 94 gallons capacity, are located in the fuselage while a 52 gallon streamlined auxiliary gas tank is hung beneath the body from the bomb-rack where it appears like a large bomb.

A hand inertia starter of the usual type is used for starting the engine. The propeller is of the detachable blade type and not a variable pitch type as it might appear.

A conventional welded steel tube type of fuselage is employed which is fabric covered aft of the engine section. Below is the Curtiss single strut type landing gear with the wheels enclosed in fairings. Oleo shock absorbers are used together with Bendix brakes. The tail-wheel is swiveled and steerable.



Does a Mile Jump

by RETTA EWERS

Congratulating Everett Wilson after his remarkable jump.

A THREE-MILE parachute jump is, in itself, no more a novelty, but when it is accomplished by a 56 year-old one-armed man who falls a whole mile before opening the 'chute, the fact takes on the aspect of unusual interest.

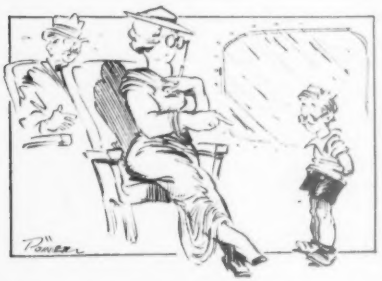
Everett Wilson, manager of the Arlington, California, airport, has thrilled thousands, for he is an old-time "Balloon Buster" and on this occasion many were thrilled when they saw him hurtling through space with the speed of Campbell's automobile at Daytonia Beach.

"I got almost as great a thrill out of the drop as I did from my first one back in Logansport, Indiana, in 1892," said Wilson.

"The sensation of dropping a mile before opening the 'chute was not so bad after the first 'sinking sensation.' It was more like floating through space for the first five or six hundred feet, then one begins to somersault.

"There was quite a jolt on my body when the 'chute opened, but no more than in other jumps I have made at lower altitudes."

Oh, Yeah?



"Oswald, you tell that fresh young pilot that your grandfather owns this airline and if you want to steer the airplane you will steer it—so there!"

The Aero-Sportswomen

by JOAN THOMAS

WE CAN'T all be famous explorers like Admiral Byrd, Roy Chapman Andrews or Prof. Piccard, but every girl who flies has had a taste of the joy of being on the fringes, at least, of a new world of experience.

There is always a certain mystery and glamour about the unknown—and though we know, as Ruth Nichols expressed it in answer to the oft repeated query, of how she had the *courage* to make her record-breaking flights, "it doesn't take courage to do the thing you are not afraid of."

Yet to be the first to accomplish something new and different is half the fun, and if we who fly in the States find we are looked upon as "courageous," how much more exciting it must be—to be the first and only woman pilot in your country!

Such is the distinction held by little Emma Cataline Encinas of Mexico.

Although a Mexican by birth, Emma has had the advantage of living in the United States as well. She spent seven years in a girls' school in El Paso, Texas, and one year in a university in Los Angeles. Then she studied dancing, had one engagement in a Franchon and Marco production and took part in two or three motion pictures: "Rio Rita" and "The Romance of the Rio Grande." After two years stage experience she returned to Mexico and established a dancing school in Chihuahua.

It was during this time that Colonel Roberto Fierro, who made the New York to Mexico flight, was sent to Chihuahua as governor. He established a flying school and Miss Encinas was one of the first to enroll. Her family were violently opposed to her doing it, but fortunately she was able to make the dancing school pay for her flying time. Then, just as she was about ready to solo, Col. Fierro was recalled to the capitol.

Senorita Emma Catalina Encinas, Mexico's only woman pilot and who, accordingly, is the recipient of many favors extended by the Mexican Air Service.

Marguerite Green, president Chicago chapter of the Women's National Aeronautic Association. Miss Green is also secretary to the Department of Commerce Inspectors, Municipal Airport, Chicago, Ill.

"But, by that time," she said, "I had gotten aviation into my blood, so I went to Mexico City. And after many difficulties (several times I was sure I would have to give it up) I finally made my first solo flight on November 20, 1932. There were four or five thousand people at the field watching me, so you can imagine how scared I was. Two weeks later, I passed inspection and received my license."

The Mexican Air Force has adopted Miss Encinas as a sort of protegé. She has had over fifty solo hours in government ships, most of this in a Bird that belongs to the presidency. Occasionally she is taken along as co-pilot in the Corsair bombers.

"I teach the officers English," she said, "and write for their magazine in return for their good will and the privilege of flying with them."

She insists she has never done anything spectacular and thinks her flying experiences are very commonplace. (Mon dieu, what an American pilot wouldn't give—to have a similar connection with the Army Air corps!) When she first got her license very few persons knew anything about it and she had several amusing experiences.

"On my first cross-country flight, as a co-pilot from Mexico City to Gelaya, Gto., when we landed I was mistaken for a young boy. They thought I was only about 17 and were all admiring the fact that one so young could fly. Then when I went to the hotel, washed up, combed my tousled hair, put on some make-up and went back to the field for the big show—were they surprised?"

The Wartime Bristol Fighter

(*See back inside cover*)

THE "Bristol Fighter," a British plane put into service during the latter part of the World War, showed very excellent performance and was highly regarded both in England and in the United States.

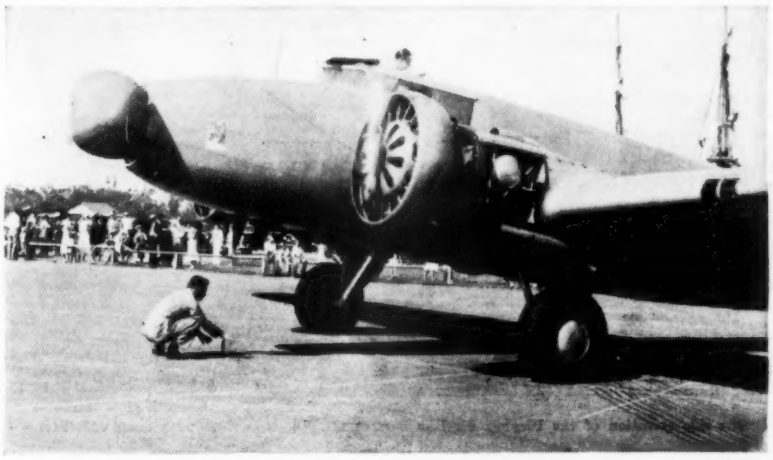
But, aside from its service in the War, it is of greater interest in this country because of the many upsets and scandals that it caused when its production was attempted over here. Many were built that never saw Europe. Because of the various delays due to governmental red-tape, the ship became obsolete before delivery could be made.

But, of the greatest interest, is the fact that the first American "Liberty Motor" was designed for powering this ship, and when the engine was ready for production, it too became obsolete with the Bristol Fighter.

This first Liberty engine was an 8-cylinder "V" that was no good for anything else than the Bristol Fighter, and when work was stopped on it, the designers turned their attention to building the celebrated 12-cylinder "Liberty 400" with which most of us are familiar. The American version of this old ship and its powerplant had a hectic history which occasioned considerable gossip at the time.

New Method of Testing Airplane Compasses

by FERRIS EMERY



Laying out the compass correction circle on the apron.

THESE photos show a novel method of testing airplane compasses. Because of the fact that airplane compasses must be tested in the plane with the engines turning over at flying speed, this presented a problem but finally a system was developed that proved usable and simple.

All that is necessary is a circle and a plumb-line. A circle is marked out on the floor or apron at the airport. True compass readings are then marked on the circle, that is, lines are drawn through the circle at every 30 degrees, starting at the North.

A plumb-line is then dropped from the ship directly below the compass or as near the center as possible. The ship is then jockied into position, placing the plumb-line directly over one of the lines on the circle. The engines are raced and compass readings taken.

GLOSSARY OF WORDS, TERMS AND PHRASES — DIC-A-5

Aerodynamic Laboratory. A laboratory employed for testing the lift, drag and stability of various bodies held in an airstream.

Aerodynamic Paradox. (1) Any device that apparently contradicts the laws of AERODYNAMICS. (2) More particularly, a propeller having a half-round blade that is rotated by the air without having the blades inclined to the air-stream.

Aerodynamic Pressure. Pressure created on surfaces by the action of moving air.

Aerodynamics. The study of forces created by moving air.

Aerodyne. A power driven heavier-than-air flying machine of the airplane type.

Aerofoil. The wing of a flyer or a curved plate designed for producing lift when placed in an airstream. See AIRFOIL preferred.

Aerofoil Sections. Various types of AEROFOILS or lifting surfaces classified according to the nature of their curvature or sectional form.

Aerognosy. AEROLOGY preferred.

Aerogram. A radio or wireless message.

Aerographer. (1) A student of the atmosphere. (2) Weather expert. (2) METEOROLOGIST is preferred.

Aerography. A description of the atmosphere.

Aerolites. Stones coming from interstellar space that fall upon the earth. Frequently called METEORS.

Aeroliths. See AEROLITES.

Aerology. The study of free air or the atmosphere at considerable heights above the earth's surface. Also, known as AEROGNOSY and AEROPHYSICS.

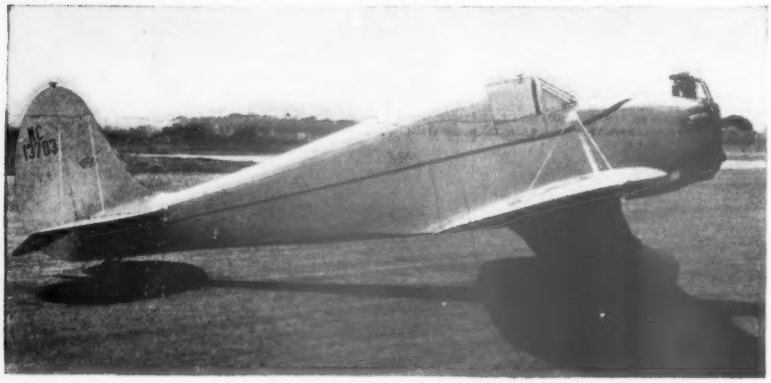
Aeromancy. The art of forecasting weather changes.

Aerometer. An instrument for determining the density of air.

VELOCITY CONVERSIONS—TAB-V-20

(1) M.P.H.	(2) (M.P.H.)²	(3) $\sqrt{\text{M.P.H.}}$	(4) FEET/MIN	(5) FEET/SEC	(6) KILOM/HOUR
1	1	1.000	88	1.466	1.609
2	4	1.414	176	2.933	3.218
3	9	1.732	264	4.399	4.827
4	16	2.000	352	5.866	6.436
5	25	2.236	440	7.333	8.045
6	36	2.449	528	8.799	9.654
7	49	2.645	616	10.266	11.263
8	64	2.828	704	11.722	12.872
9	81	3.000	792	13.199	14.481
10	100	3.162	880	14.666	16.090
11	121	3.316	968	16.133	17.699
12	144	3.464	1056	17.599	19.308
13	169	3.605	1144	19.055	20.917
14	196	3.741	1232	20.533	22.526
15	225	3.873	1320	22.000	24.135
16	256	4.000	1408	23.466	25.744
17	289	4.123	1496	24.933	27.353
18	324	4.242	1584	26.399	28.962
19	361	4.358	1672	27.867	30.571
20	400	4.472	1760	29.333	32.180
21	441	4.582	1848	30.800	33.789
22	484	4.690	1936	32.266	35.398
23	529	4.795	2024	33.733	37.007
24	576	4 899	2112	35.200	38.616
25	625	5.000	2200	36.666	40.225
26	676	5.099	2288	38.133	41.834
27	729	5.196	2376	39.600	43.443
28	784	5.291	2464	41.066	45.052
29	841	5.385	2552	42.533	46.661
30	900	5.477	2640	44.000	48 270
31	961	5.567	2728	45.466	49.879
32	1024	5.656	2816	46.966	51.488
33	1089	5.744	2904	48.400	53.097
34	1156	5 831	2992	49.866	54.706
35	1225	5.916	3080	51.333	56.315

The Kinner "Playboy" Introduces a New Type of Sportplane



The side elevation of the Playboy displays new slender fuselage lines with good visibility.

VERY recently, the Kinner Airplane and Motor Corporation, Ltd., have introduced a 2-place sportplane to be known as the Kinner Playboy. One of the outstanding features of this ship is the fact that it can be instantly converted into either an open or closed type plane while in flight by means of sliding panels in the fuselage.

It is powered with a 160 h.p. Kinner engine (Type R-5) which gives it a top speed of 135 m.p.h. and a sea-level climbing rate of 800 feet per minute. In addition to the pilot and passenger, the Playboy is licensed to carry 52 gallons of gasoline and 122 pounds of baggage. The passenger and pilot are seated side-by-side.

The Playboy is a wire-braced low-wing monoplane with wings of a composite structure. Spruce spars, moly compression struts and double drag and anti-drag tie-rods are employed. The wing is covered with fabric. It is interesting to note the Frise type ailerons which are operated by differential control. Chrome-moly wing stubs are built integral with the fuselage.

A rectangular fuselage structure of welded chrome-moly steel tubing is faired into an oval section and covered with fabric. To this fuselage is attached a divided type undercarriage with cantilever forks fastened to the apex of a rigid wire braced "V" unit. The tail group has a welded steel frame covered with fabric, braced with streamline wires. The fixed stabilizer is fitted with tab control for balance or trimming while in flight.

SPECIFICATIONS OF KINNER PLAYBOY

Wing span	29 ft. 0 in.
Wing chord	6 ft. 0 in.
Wing area	142 sq. ft.
Length	24 ft. 2 in.
Height	7 ft. 9 in.
Power-plant	160 h.p. Kinner

WEIGHTS AND LOADING

Weight, empty	1370 Lbs.
Weight, useful	800 Lbs.
Weight, gross	2170 Lbs.
Wing loading	15.27 Lbs./Sq. Ft.
Power loading	13.56 Lbs./H.P.

PERFORMANCE

Top speed	135 m.p.h.
Cruising speed	125 m.p.h.
Landing speed	55 m.p.h.
Climb at sea-level	800 ft. min.
Take-off, sea-level	5 secs.
Service ceiling	14,000 ft.
Absolute ceiling	16,000 ft.
Cruising radius	5 hrs.

VELOCITY CONVERSIONS—TAB-V-21

(1) M.P.H.	(2) (M.P.H.)²	(3) √M.P.H.	(4) FEET/MIN	(5) FEET/SEC	(6) KILOM/HOUR
36	1296	6.000	3168	52.800	57.924
37	1369	6.082	3256	54.266	59.533
38	1444	6.164	3344	55.733	61.142
39	1521	6.245	3432	57.200	62.751
40	1600	6.324	3520	58.666	64.360
41	1681	6.403	3608	60.133	65.969
42	1764	6.480	3696	61.600	67.578
43	1849	6.557	3784	63.066	69.187
44	1936	6.633	3872	64.533	70.796
45	2025	6.708	3960	66.000	72.405
46	2116	6.782	4048	67.466	74.014
47	2209	6.855	4136	68.933	75.623
48	2304	6.928	4224	70.400	77.232
49	2401	7.000	4312	71.866	78.841
50	2500	7.071	4400	73.333	80.450
51	2601	7.141	4488	74.800	82.059
52	2704	7.211	4576	76.266	83.668
53	2809	7.280	4664	77.733	85.277
54	2916	7.348	4752	79.200	86.886
55	3025	7.416	4840	80.666	88.495
56	3136	7.483	4928	82.133	90.104
57	3249	7.549	5016	83.600	91.713
58	3364	7.615	5104	85.066	93.322
59	3481	7.681	5192	86.533	94.931
60	3600	7.746	5280	88.000	96.540
61	3721	7.810	5368	89.466	98.149
62	3844	7.874	5456	90.933	99.758
63	3969	7.937	5544	92.400	101.367
64	4096	8.000	5632	93.866	102.976
65	4225	8.062	5720	95.333	104.585
66	4356	8.124	5808	96.800	106.194
67	4489	8.185	5896	98.266	107.803
68	4624	8.246	5984	99.733	109.412
69	4761	8.306	6072	101.200	111.021
70	4900	8.366	6160	102.666	112.630

GLOSSARY OF WORDS, TERMS AND PHRASES — DIC-A-6

Aeronat. Lighter-than-air ship. A dirigible or powered balloon.

Aeronaut. A balloonist or operator of lighter-than-air craft.

Aeronautic. Relating to aerial navigation or flight.

Aeronautical Mile. This is identical with the nautical mile, an arc of 1 minute of latitude, or approximately 6,080 feet.

Aeronef. Heavier-than-air flying machine.

Aeronon. Lighter-than-air craft.

Aeroplane. (See AIRPLANE). A powered heavier-than-air flying machine suspended in air on fixed wings, pressure and lift on the wings produced by their forward motion through the air. The preferred word in the United States is AIRPLANE, since 1918.

Aeroplane Elements. The main load supporting wings, variable control surfaces for balancing and steering, an engine and a propeller for pulling the aeroplane through the air so that there is relative motion between the wings and air.

Aerosphere. The blanket or sheath of air (atmosphere) that surrounds the earth.

Aerostat. A balloon or other lighter-than-air craft.

Aerostatic. The study of air buoyancy or the equilibrium of gases.

Aerostatic Gases. Gases lighter-than-air, used for filling balloons or dirigibles. The most common gases are hydrogen, helium or coal gas.

Aerostation. The art of handling lighter-than-air craft.

Aerostrata. The thickness of the atmospheric layer around the earth.

Aero-surface. The surface of an AEROFOIL or wing employed for sustention by AERODYNAMIC FORCE.

Aery. (1) The nest of an eagle or other large bird located at a great elevation. (2) An elevated location.

Comments on the New Deal

by LESLIE LONG

While the New Deal is being passed around, why not give the amateur and the aviation experimenter a taste of the "New Freedom," contends Mr. Long. Once numerous, the race of amateur flyers is becoming scarce as hen's teeth.

BOTH the social and commercial groups of the nation are being given a New Deal. In fact, a whole series of New Deals. Most of them will no doubt work out well, and some of them will be failures. But there is one thing certain, however, that out of all these new deals, aviation is not drawing a single good card.

A few years ago, the Federal Government decided it was its brother's keeper and so proceeded to take full control of the infant giant—Aviation. As to the effect of this on the commercial side of the young industry, everyone may judge for himself. Undoubtedly much of it was for the best.

The effect of the control on amateur activities, however, was prompt and complete. The amateur sank without trace. Five years ago we had a lusty young industry, or science, or art—just as you please—and today we have but a few bitter memories. Official meddling and stupidity have done their work quickly and effectively.

The Reformer Buries the Amateur Deep

With both the Federal and State authorities busy with the shovel, how long will the amateur exist?

At this time, the press is carrying reports of an attempt to revive the child. It seems that the Department of Commerce is trying to sound out the public as to its reaction in case a suitable private plane were offered at a popular price. From the tone of the literature being sent out, such a ship would be more or less subsidized.

This move, by the Department of Commerce, is a perfect example of its total lack of understanding of conditions as they exist. The group to whom they would have to turn if their plan were put into effect, is the very group that they have so effectively choked out of existence. The owners of the old planes, they so blithely grounded, are the ones who would have to buy the new designs. Does anyone think they are in a mood to buy them?

In 1928 there were about 15,000 unlicensed airplane builders and pilots in this country. Today it is doubtful if five per cent of them are still in the game. Naturally, the depression had something to do with this—but not much. Legally or illegally, they were FORCED out. Every hindrance was put in their way. They were told to get out of the air and stay out.

If the owner of a home-built ship complained, he was told that all he needed was a license or an A. T. C. No one told him how he was going to pay $1,000 for a stress analysis, nor how he was going to get it to Washington for tests, nor what he was going to do about it in case his application was rejected. Certainly, try to get a license, spend a fortune and two years time doing it, and you may lose out, even then.

If the young men mentioned had been allowed to go ahead, even under reasonable restrictions, they would now be the boys who would buy these new airplanes. They would have the technical ability and the flying skill to use them. More than that, they would have the desire and the grasp of details that are essential in a venture like this. To put it shortly, they would be both air-minded and competent.

Whom does the Department expect to buy these planes if offered? Surely not bank clerks, brick masons or doctors! The latter haven't the desire in the first place and they haven't the groundwork of technical understanding, even if they did have the urge. They would have to spend much time and money learning to fly on top of the cost of the plane.

But this is only one phase of the wrong that has been done. The "splendid isolation" of this country is gone forever. Most of our leaders admit that within a few years America must fight for its existence. No one doubts that all future wars will be won or lost in the air. Such being the case, let's ask a question.

Who would you prefer as a fighting pilot, a man suddenly jerked away from his grocery store counter, given two or three months intensive training on a machine of which he has no understanding, or a man who has grown up with airplanes, who knows them and loves them for what they are, their possibilities and limitations? There could be but one choice.

There is not an official on earth who can validly deny the above statements.

The country would be far safer and better prepared for any emergency if it had skilled men to call upon in a pinch. The industry would be far better off if it had an experienced and enthusiastic market for its products. The science, as a whole, would be greatly advanced if there were one hundred men experimenting where there is now but one. Academic learning tends to run in ruts. It is the uninfluenced dabbler who usually stumbles on the great discoveries.

Neither the Department nor any of the various authorities have given any valid excuse for the restrictions that have been imposed. The reason is that there are none. As to personal safety, it is nobody's business. As to public safety, there is little danger and, at the worst, less danger than from "legal" flying, simply because of the type of equipment used.

If private flying is to ever prosper, if we hope to have an adequate fighting force in emergency, if personal liberty means anything, then, the Department of Commerce and the various ruling bodies should immediately right

(*Concluded on page* 132)

Gyroscopic Forces Are

by

J. D. VAN VLIET

Aeronautical engineer, specializing in stress analysis and airplane development.

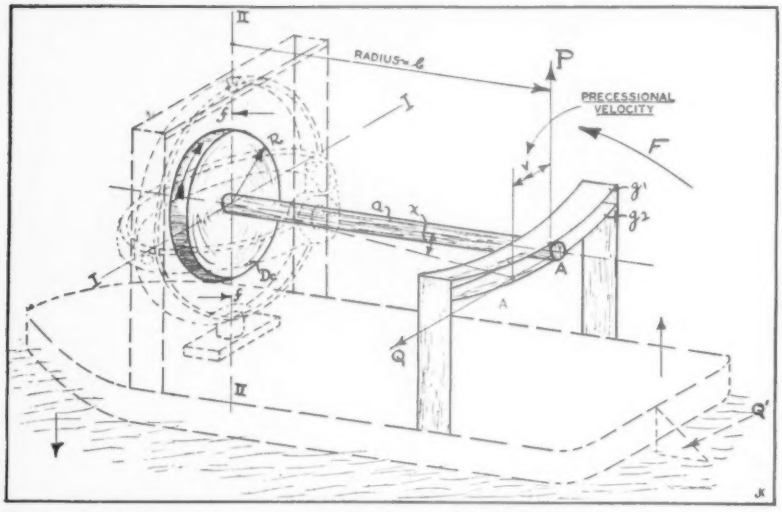


Fig. 1. In this diagram, the rotor is suspended in a gimbal (shown dotted) attached to a floating platform.

THIS article presents an elementary explanation of the principle of the gyroscope as exemplified by the propeller of an airplane and offers a simplified formula by means of which the constructor or aviator can easily calculate the effects of the gyroscopic force on the performance of his plane when making a sharp turn either in a horizontal or vertical sense.

A great deal of attention is usually given to the effects of propeller torque and various adjustments are made on the tail fin and wings of the airplane in order to counteract the effect of the propeller torque and to obtain perfect lateral and longitudinal stability. But as a rule little or no attention is accorded to the gyroscopic forces created by the propeller although these forces are often of sufficient magnitude to produce serious disturbances in the directional control of the airplane.

While it is true that these disturbances are almost automatically counteracted by the *experienced* aviator, it is equally true that they have frequently been the cause of many a deplorable accident which could have easily been prevented by a proper understanding of the forces produced by the rapidly spinning propeller acting as a gyroscope.

In general, the gyroscope may be defined as a revolving disc or similar body suspended in such a way as to be able to change its axis of rotation in any direction. This change is effected by an outside force which induces a second force acting at right angles to the first one. The simplest kind of gyroscope is represented by a rotating disc such as is shown in Figures 1 and 2. Referring to Figure 1 it is seen that the vertically placed disc Dc, having the radius R is mounted on the horizontal axle a. This axle is mounted in gimbals which are shown in dotted lines so as not to obscure those main elements which are analogous to the propeller and the propeller shaft of an airplane.

The disc Dc rotates about the horizontal axis which coincides with the axle a, the axle being journaled on the horizontal or inner gimbal ring which is rotatable about the horizontal transverse axis I. The inner gimbal ring is journaled in the outer or vertical gimbal ring, mounted in such a way as to be rotatable about the vertical axis II. Either of the axes a, I, and II is thus *normally* at right angles to any of the other two.

The end A of the axle a is guided between the horizontal upper and lower guides g1, and g2, which in shape conform to the arc of a circle having the radius C.

Viewed from the guides the disc Dc is assumed to spin in a clockwise direction as indicated by the circumferential arrow. Now, if a force Q is applied to the end A of the axle at right angles thereto and in a horizontal plane, and if the axle is thereby brought to the new position A' as shown in dotted lines, the disc D will be skewed accordingly. In process of doing so, it will evince a strong tendency to turn over forwardly as indicated by the small arrows f-f, and since the axle and the disc are integral, the axle would thereby be tipped up at the end. The axle end A however, is restrained from moving in a vertical sense by the guides and consequently an upward pressure P is exerted against the upper guide, the force P persisting so long as the axle is allowed to move. By virtue of this gyroscopic force P acting at the end of the leverarm C, the combined disc, axle and guides would then have tendency to rotate jointly in a vertical longitudinal plane in the direction of the arrow F.

In Figure 1 the gimbal mounting has been included in order to illustrate what would happen if the disc axle were not in any way restrained at the end. It is obvious, however, that with this mode of mounting a spinning motion could not be imparted to the disc by any mechanical means since the axle a would move in a horizontal as well as in a vertical sense and would thus interfere with the mechanical transmission of power. The gyroscope axle a should therefore run in fixed bearings and the rotational motion would be transmitted by a fixed motor or transmission acting on the axle. If the

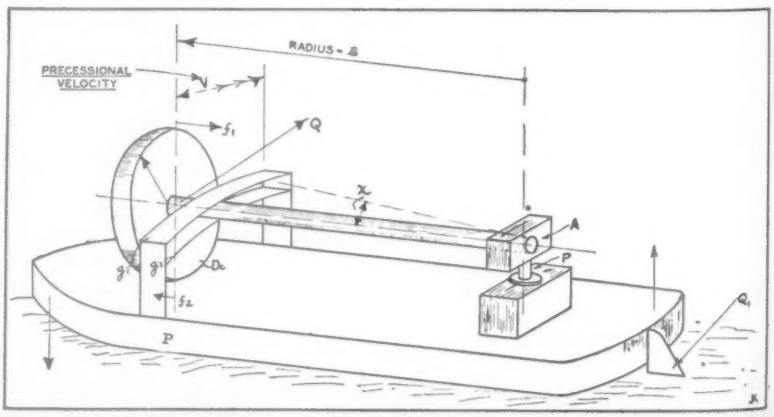
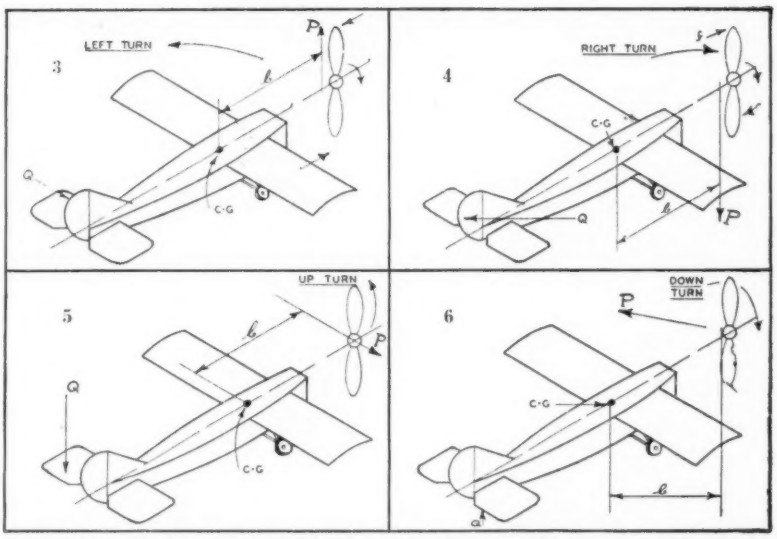


Fig. 2. One end of the shaft is pivoted while the rotor end is restrained by a circular guide slot.

Important to Aviation

THE gyroscope, its motions and the forces created by it have always been more or less shrouded in mystery so far as the layman is concerned, because of the difficulty of giving a simple explanation of the phenomenon. In short, textbooks on this subject do not enable the student to visualize the reactions.

In this article, however, Mr. Van Vliet greatly simplifies the theory of the gyroscope and has arrived at an analysis which can be understood by anyone familiar with elementary mathematics.



Figs. 3-4-5-6. Illustrating the gyroscopic effect of a rotating propeller upon an airplane during horizontal and vertical turns.

foundation on which this collective mechanism is mounted were fixed, no joint rotation would be possible and the gyroscopic force would only manifest itself in a strain on the bearings and guides and bending stresses in the axle. If the collective mechanism, however, were placed on a small boat floating in water, with the disc Dc facing the bow, the gyroscopic moment PC (force times leverarm) would have the effect of raising the stern of the boat and of dipping the bow down.

If the force Q were applied in a direction opposite to that shown in Figure 1, causing a correspondingly reversed precessional velocity of the point A, the gyroscopic force P would act *downward* since the disc would then want to turn over backward instead of forward; the rotation of the entire system would then take place in a direction opposite to that indicated by the arrow F. When placed on a boat, the stern of the boat will go down and the bow would be raised.

A modified way of mounting the gyroscope has been shown in Figure 2. The end A of the axle here is journaled in such a way as to prevent its vertical motion. It is allowed, however to swing horizontally on the vertical pivot P. The guides g1 and g2 have been placed close to the disc Dc. The leverarm C is of the same length as in the previous case and is measured from the center of the disc to the axis of the pivot. Theoretically of course the guides should pass through the center of the disc.

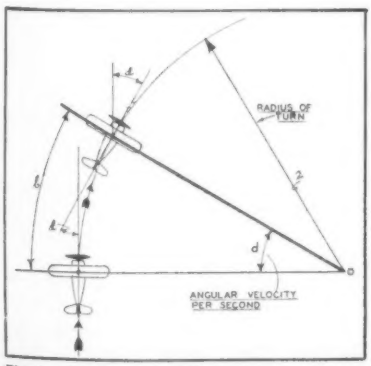


Fig. 7. Accelerations during a horizontal turn.

In order to skew the disc Dc round to the same extent as in Figure 1, the force Q must be applied at or near the disc in a direction opposite to that shown in Figure 1. The relative angular deviation of the axle then remains the same as before. The gyroscopic force P then acts *downward* at the disc, instead of upward at the end of the axle, so that the rotation of the collective mechanism again takes place in the direction of the arrow F. When placed on a boat, the bow would dip down and the stern would be raised, hence the arrangement shown in Fig. 2 is the functional equivalent of that shown in Figure 1. It is self-evident that when the mechanism is placed on a boat, the gyroscopic force P can be created even when the disc and axle are so mounted that no angular deviation of the axle is possible for if the boat is moving forward in a straight line, and then steered into a turn by a rudder, the force Q would be acting on the rudder while the boat is turning and a gyroscopic force would be created which would cause the trim of the boat to be modified accordingly. If the gyroscope were placed on an airplane the same results would be obtained.

The conditions illustrated in Figures 1 and 2 also apply when the mechanism is placed on end and it should be kept in mind that a reversal of the rotation of the disc produces a reversed gyroscopic force.

Figures 3, 4, 5 and 6 illustrate the effect of the gyroscopic force produced by the rotating propeller during a turn, with due regard for the fact that the airplane as a whole will rotate about its center of gravity whenever a disturbance of its longitudinal or lateral stability occurs. In the cases shown the propeller rotates clockwise when viewed from the cockpit of the plane.

In Fig. 3, the plane is assumed to make a left-hand turn, consequently the gyroscopic force P acts upward at the propeller. The plane will accordingly have a tendency to nose up and climb.

In Fig. 4, the plane is assumed to make a right-hand turn. The force P then acts downward at the propeller and the plane will tend to nose down.

In Fig. 5 the plane is assumed to make a turn upward in a vertical plane, as at the beginning of a zoom or loop. The gyroscopic force P acts to the right and thus tends to pull the plane off its course, whereas on the downward turn, as in Fig. 6, the gyroscopic force P acts to the left and will thus cause a corresponding deviation from the intended trajectory unless counteracted by the controls. When the plane is making a turn of considerable radius

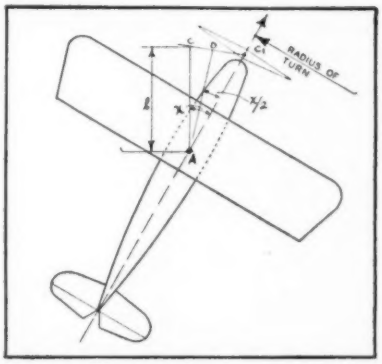


Fig. 8. Resolution of forces on a plane in a turn.

these influences will hardly be noticeable and the damping effect of the wings and stabilizers will usually be sufficient to prevent directional deviation. On fast, high powered planes, the gyroscopic effect however will be very noticeable, especially so when short turns are attempted.

In all the above considered cases the gyroscopic moment equals the product of the gyroscopic force P times its leverarm C to the center of gravity of the machine.

The magnitude of the gyroscopic moment is determined by the following formula:

$$PC = \frac{W}{g} K^2 \left(\frac{IIN}{30}\right) V/C \text{ ft. lbs.} \quad (1)$$

Where P=gyroscopic force in lbs.

C=the distance from the center of the propeller to the center of gravity of the airplane in feet.

W=the weight of the propeller.

II=3.1416.

K=the radius of gyration of the propeller in feet.

N=the revolutions per minute of propeller.

V=*the precessional velocity*, i. e., the linear velocity of the center of the propeller about the center of gravity of the plane in feet per second.

g=acceleration due to gravity=32.17 feet per second per second.

Of the above quantities the only one that cannot be established by a simple calculation is the radius of gyration K of the propeller.

The radius of gyration of a body is expressed in the formula:

$$I = K^2W$$

in which I is the moment of inertia, K the radius of gyration measured from the axis of gyration and W the weight of the body.

If the propeller were a homogenous disc, like that of the gyroscope in Figure 1 and 2, the radius of gyrations would be K=.707 R, when R is the radius of the disc. It is obvious however that the propeller does not conform in shape to any geometric figure which would facilitate the calculation of its moment of inertia or of its center of percussion, from either one of which the radius of gyration could be calculated. On account of the helicoidal twist of the blades the length axis of a series of radially consecutive sections varies in direction from nearly parallel to the axis of rotation near the center to nearly at right angles thereto at the tip, and an accurate computation of the total moments of inertia would require a great deal of time and work. It could be done in less time by the pendulum method, that is, by suspending the propeller at a point outside the center of gravity and noting the time t required for a single oscillation, the value of t thus obtained to be substituted in the formula $WXogt^2/II^2$, where W is the weight in pounds. Xo the distance from the axis of oscillation to the center of gravity and g the acceleration due to gravity=32.17 feet second, per

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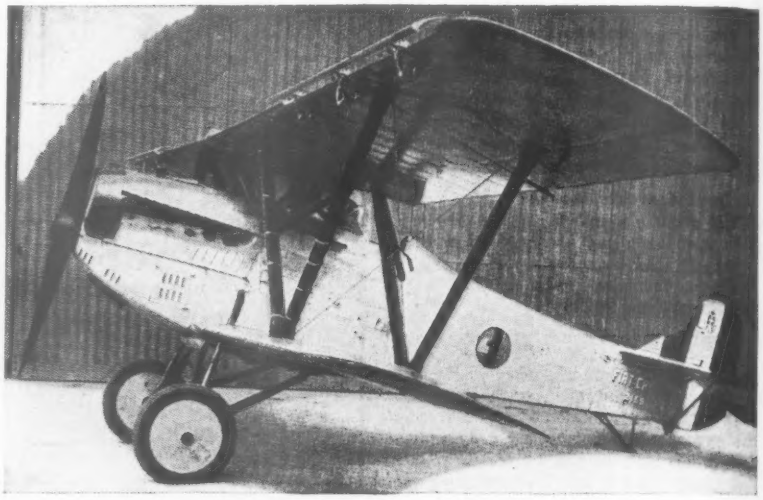
QUESTION AND ANSWER DEPARTMENT

All questions of general interest on any phase of aviation will be answered authoritatively by POPULAR AVIATION'S Technical Staff.



Actual tests on the landing gear of this plane indicated that the gear plus wheels constituted 31.83 per cent of the total resistance.

QUESTION:—A. D. Wolf, LaCrosse, Wis. *Can you give me the list of stopping places made by Wiley Post on his flight around the world, the time between each stopping point and the total time?*

Answer:—THE total time made by Post on his 'round the world trip was 115 hours, 36 minutes, 30 seconds, or a total of 7 days, 18 hours, 49 minutes, 30 seconds. The total distance was 15,596 miles. The stopping points and the time between these points are as follows:

0.	New York City		Starting point
1.	Berlin	25	H—45′—00″
2.	Koenigsburg	4	H—30′—00″
3.	Moscow	5	H—15′—00″
4.	Novosibirsk	13	H—15′—00″
5.	Irkutsk	6	H—33′—00″
6.	Rukhlovo	7	H—32′—00″
7.	Khabarovsk	4	H—20′—00″
8.	Nome Flat	22	H—32′—00″
9.	Fairbanks	3	H—14′—00″
10.	Edmonton	9	H—22′—00″
11.	New York City	13	H—18′—30″

During the greater part of the time bad weather prevailed, which made the flight very difficult. The Sperry Automatic Pilot which was in charge of the ship for long periods, was a real help.

* * *

QUESTION:—Arthur Schneider, Amsterdam, N. Y. *How does a 6-cycle engine operate and what are its advantages? Are any such engines now availabld on the market?*

Answer:—THERE are several methods of conducting the events of a 6-cycle engine, but in general, the object is to get more perfect scavenging in the cylinder and, therefore, less dilution of the gasoline-air mixture with the burned gases left from the previous combustion. The cycle of operations is completed in six strokes or three revolutions.

(1) Working or power stroke. (2) Expulsion stroke, piston forcing out part of burned gas. (3) Pure air suction stroke in which pure scavenging air is drawn into the cylinder. (4) Air scavenging stroke in which air sweeps out remainder of burned gas. (5) Mixture suction stroke drawing gasoline-air vapor into cylinder. (6) Mixture compression stroke. Ignition at the end of this stroke. As cold air and the mixture are both drawn into the cylinder on separate strokes it is much easier to cool this engine than the common four-stroke engine.

* * *

QUESTION:—Julius Anderson, St. Paul, Minn. *Where are the ailerons most effective, on the top wing or lower wing of a biplane?*

Answer:—IN normal flight they are most effective on the top wing, but in making landings they are more effective on the lower wing because of the compression between the ground and the wing.

* * *

QUESTION:—Fred Sterling, Nashville, Tenn. *I should think that landing wheels with flexible spokes would be an ideal arrangement for an airplane. The spokes would take up shocks and thus reduce the duty of the tires.*

Answer:—THIS has been tried several times, the Ackermann flexible spoke wheel introduced during the war being the best example. It was found that such wheels are very heavy and are weak laterally. And then, the solid rubber tires necessary with such wheels do not give the proper amount of bearing surface.

(*Concluded on page* 120)

More About Helicopters

by ALVIN EDWARD MOORE

While unknown to the general public, there has been a tremendous amount of experimental work performed in the development of the direct-lift helicopter. This matter is well worth your attention.

BREGUET, Forlanini and the Dufaux Brothers were not the only pioneers that struggled with the problem of vertical flight. The patent records are full of their dreams. But Breguet solved the first and probably most important part of the problem.

Cornu and Oehmichen, of France, and Emile Berliner, famous inventor of the disc talking machine, his co-worker, J. Newton Williams, and his son, Henry Berliner, of America, built and flew machines of the first or multiple-point sustention type.

Paul Cornu experimented with a helicopter model in Lisieux, France, in 1906-07, and early in 1908 built a full-sized craft. The latter machine had two two-bladed helicoptive propellers mounted on horizontal, wire-spoked pulleys at the opposite ends of a long, bent framework of tubing. The propellers were rotated in opposite directions by a crossed belt. At its center, this belt passed over a pulley on the end of a vertical crankshaft that extended up from an engine mounted in the bent part of the tubular framework. For forward motion the inventor depended on the reaction of the air from the propellers on two shiftable surfaces.

In the first week of April, 1908, this helicopter rose a foot or two from the ground, with Cornu aboard. Thus, Cornu had the distinction of being the first man to rise into the air in a helicopter. A foot or two seems little, and yet it was a great deal. The first powered flight of an airplane was for a distance of only one hundred and twenty feet.

Cornu experienced the same difficulty of balancing his craft as did all the inventors of the multiple-point sustention type of helicopter. One day while he was in the air and rising, with the little engine faithfully pounding away, the forward part of the framework suddenly tipped upward. The craft was headed for a somersault.

Now, I don't know what aviation would have done without the brothers of its pioneer inventors. Wilbur Wright had Orville and Orville had Wilbur; the great pioneer, Otto Lilienthal, was aided in his experiments by his brother Gustave; the two Montgolfier brothers of France made balloon history; and Paul Cornu also had a brother, who was aiding him at this juncture. When a bad crash and bodily harm stared Cornu in the face, his brother leaped to the machine, grabbed the rapidly rising front part before it was out of reach and threw his weight upon it. Gradually he pulled it down to its normal position. In the meantime Cornu had shut off the engine, and the machine settled to the ground.

—*Courtesy of U. S. Army Air Service.*

The complicated helicopter of Dr. George de Bothezat, is shown in flight. It was built under the auspices of the U. S. Army Air Service.

They found that one of the pulleys had become disconnected from the belt, causing all the lifting force to be applied to the front propeller.

This tendency to become unbalanced has been inherent in all helicopters of the multiple-sustention type. It can be overcome only by complicated structure, such for instance, as a pendulum-controlled system for automatically changing the pitch of the various propellers. Furthermore, the very number of the propellers adds to the weight and complexity of the craft.

It would seem that machines of the second type, with helicoptive propellers rotating in only one axis, would be simpler and better. We have seen that Leonardo da Vinci's design and Enrico Forlanini's steam-powered model were of this type. Thomas A. Edison, who was greatly interested in the helicopter, patented such a machine in 1910. And during the late World War an Austrian captive helicopter of this type was developed by two inventors, Petroczy and Karman.

The Petroczy-Karman craft, attached to the ground by three anchored cables which were let out from the machine as it ascended, was used for observation of the enemy allied lines. It comprised two large helicoptive propellers, one above the other, rotated in opposite directions by concentric shafts geared to three engines. With four men on board, it rose to and hovered at an altitude of 160 feet. It demonstrated, as did the model of Forlanini for that matter, the superior balancing ability of the one-point sustention type of helicopter. But its propeller blades were not flexible in the manner of Breguet's, so that two oppositely rotating propellers had to be used to counteract the objectionable torque.

Now, as Otto G. Luyties, a scientific inventor of the helicopter, pointed out in 1908, when two propellers thus rotate one above the other, the lower has very little efficiency due to the fact that it works in the downstream of air from the upper. Thus the lower propeller of the Petroczy-Karman machine did not fully neutralize the tendency of the upper propeller to unbalance the shaft. Neither was the torque of the engine fully neutralized.

The torque of an engine in the air is one of the major problems of the helicopter. As Sir Isaac Newton discovered two or three hundred years ago, and as most of my readers know, for every action there is an equal and opposite reaction. When an engine is based on the earth, the ground absorbs the equal and opposite reaction to its force but in a helicopter in the air there is nothing to absorb the reaction which tends to whirl the carriage in a direction opposite to the engine's rotation of the propeller. This reaction or torque of the engine is the reason why Breguet could not place his flexible-bladed propellers directly above the center of gravity of the machine, harness it to an engine and fly. It is also the reason why the rotative vanes of the autogiro are not propelled by an engine.

Despite the fact, however, that a helicopter of two oppositely rotating propellers one placed above the other does not embody a complete solution

of our problem of neutralizing torque, its type has been more successful than any other to date.

Dr. Peter Cooper Hewitt, and Professor Francis B. Crocker of the United States have done a great deal of experimental work and secured many patents on helicopters which neutralize the torque of the engine in this fashion. In their patent of 1920 they also attempted to balance the difference in lift between the forwardly moving airscrew blade and the rearwardly moving blade by making the inner ends of the rotating blades flexible and therefore automatically variable in pitch by the air pressure, instead of hinging the whole of the blades to the shaft or mast as Breguet did.

The broad idea of warpable wing parts of course, was the conception of Wilbur Wright in 1899; and strangely enough Orville Wright apparently was the original inventor of wing surfaces hinged at their base for stability, but neither Wilbur nor Orville remotely conceived a warpable wing tip or a hinged blade rotating on a vertical axis as a means of raising a helicopter. Their conceptions merely show how closely connected are the ideas of all able inventors working on the same problems.

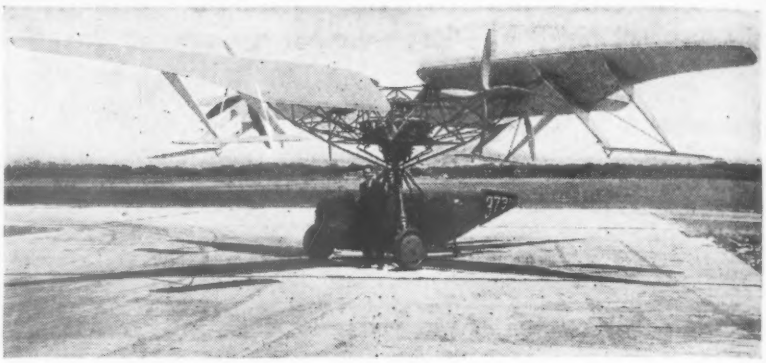
Hewitt and Crocker built one machine that flew. With two large slowly rotating wings moving in opposite directions, it lifted some 250 pounds more than its dead weight. They were almost on the right track.

Marquis de Pescara, Italy, built a one-point sustention helicopter with two oppositely rotating vertical airscrews about twenty-one feet in diameter. Each screw had six blades in the form of strutted biplanes, not hinged to the rotating central shaft. He secured horizontal motion by changing the angle of incidence of the blades. In 1923 de Pescara flew his craft 736 meters. He demonstrated the machine in Spain and France.

Now we come to the most successful craft of this type, that of the Italian, Corradino D' Ascanio, which flew in 1931 at the Ciampino Nord Aerodome in Italy. Its airscrews were two large superposed wings *hinged* to a central, rotating shaft. Thus Breguet's idea of hinged rotating wings was incorporated with the imperfect means of neutralizing torque embodied in the 1877 model of Forlanini.

By pure process of reasoning, therefore, one would expect D'Ascanio's solution (patented in the leading industrial countries in 1932) to be fairly successful. And so it was. He took off and landed in a circle forty-nine feet in diameter, and rose fifty-nine feet, thus establishing a new altitude record for the helicopter. He broke the previous endurance record by a flight of 8 minutes 45½ seconds. The craft, whose fuselage was somewhat like that of de Bothezat—in the form of a cross, with small vertical steering propellers at the extremities of the arms of the cross—flew with great steadiness.

Despite its record flight, however, the D'Ascanio helicopter does not seem to be the best solution of our problem. In my opinion de la Cierva pointed the way to a better solution when he created his autogiro, with its single sustention rotor, rotating just above the center of gravity of the machine. Several inventors seem to have realized that an entirely successful solution of the helicoptive problem as a whole will come only when de la Cierva's single rotor, with the hinged blades of Breguet, is rotated by an engine. They are trying to counteract the torque of the engine by methods different from that of Forlanini, Breguet, Cornu, Berliner, D'Ascanio and the rest.



Maitland B. Bleecker standing by his invention, the Curtiss-Bleecker helicopter, completed in 1930 after four years of exhaustive research and wind-tunnel tests. Little is known of its performance.

In the United States, for instance, there is Maitland B. Bleecker, a young aeronautical engineer, the inventor of a helicopter which now is being developed by the Curtiss-Wright Aeronautical Corporation. Breguet's basic idea of rotating hinged wings is present in it, but Bleecker rotates the wings by a small secondary propeller in front of each of four blades. Each of these small propellers thus pulls its rotating blade or wing surface much as the common airplane propeller pulls its rigid wing surface.

They are connected by shafts and gearing with a motor mounted in the frame just above the fuselage. By a somewhat complicated system, Bleecker neutralizes the torque of the engine, mounting it free to revolve with the rotating blades of the vertical airscrew. Thus the motor, helicoptive propellers and secondary propellers rotate as a unit, but the fuselage, being mounted independently of the rotating unit, does not rotate.

Bleecker's novelty in this craft apparently resides in his mounting of the motor to overcome its torque, since the hinging of the blades, as we have seen, was invented by Breguet, and the use of a secondary tractive propeller in front of each blade was conceived by William Cowell Sly of Kent, England in 1906. Bleecker's motor mounting might possibly prove to be the best immediate solution of our problem of torque. His machine, however, has the disadvantage of requiring a great deal of shafting, gears and other heavy parts.

In England we find an Italian, Vittorio Isacco, working for the British Air Ministry, as a prophet with honor in a foreign country. He has invented and developed a type of helicopter that has all the simplicity of most important inventions. He calls it a "helicogyre."

This helicogyre essentially is an autogiro with an engine, a gas tank and a secondary propeller for each sustaining blade. The propeller vanes, of which there are two, are thus driven by a stronger power than that of the slip stream of the autogiro. One of Isacco's machines, weighing 1,320 pounds, powered with two small engines of only 32 H.P., rose several times in 1929.

The British Air Ministry seems to be satisfied with Isacco's basic structure. Its embodiment of a simple solution to every problem of the helicopter would seem to indicate that it is the end of our immediate quest.

Let us assume that it is basically the right helicopter. As the years pass, the gasoline engine in the rotating wings will be displaced by some other more powerful engine. Even before the time grows ripe for space-ship experiments, we should have helicopters of this type powered by reaction or rocket engines.

The reaction engine of course is an industrial art in itself. Hero of Alexandria, Egypt, long before the beginning of the Christian era invented and built a small steam engine which operated on the reaction principle. Probably the first steam engine and the first rocket engine in the history of the world, it consisted of a metallic spherical container connected to a source of steam and mounted for rotation. Two bent spouts, or pipes in the form of elbows, provided outlets for the vessel. When steam was introduced into the sphere, it issued from the bent spouts and the reaction to its impingement upon the air set the sphere in rotation.

Sir Isaac Newton also invented a steam engine to utilize the reaction from escaping steam. In his device the steam escaped from the rear and its reaction forced the engine forward.

In recent years a rocket-powered

(*Concluded on page* 129)

Determining the C. G. Location

by VERNON W. PAYNE

Here, Mr. Payne answers an oft repeated request. He shows how to calculate the location of the center of gravity, with particular reference to the "Knight Twister" lightplane.

IN A previous article I have told you how to locate the wings of a plane in relation to the center of gravity, but have not told you how to find the center of gravity itself, a most necessary operation.

Of course, you can first build the fuselage with all items in it and then balance it over a saw-horse, but this is a costly way to solve so simple a problem and may lead to a lot of last-minute alterations.

To begin our calculations, we must know the weights of all items such as the propeller, engine, gas tank, oil and tank, landing gear, fuselage, tail surfaces, and tail skid. We should also know the center of gravity of each of these items within itself. The engine manufacturer can give the location of the C. G. of his product or we can find this point ourselves by experiment.

In Table No. 1 are listed all of the items, their weights and the distances of these items from a reference line called the "Datum Line." This datum line is usually taken at the front surface of the rear plate in the propeller hub but any other point will do as well. These distances, which are measured from the datum line, are called the "Lever-Arms" of the weight items.

Notice, that in Column No. 1, that all items are listed except the wings. We are to find the center of gravity first without the wings and then later place the wings on the fuselage in proper relation to the center of gravity. In Column No. 2 are the weights of the items. In Column No. 3 are the vertical lever-arms, or the distance that the item is above or below the thrust-line. Column No. 4, called the "Vertical Moment," is the result of multiplying Column No. 2 by Column No. 3. Column No. 5 is the Horizontal Lever-Arm of each item, measured back from the rear plate of the propeller hub. Column No. 6 is the result of multiplying Column No. 2 by Column No. 5.

To find the Horizontal location of the center of gravity, divide the total of Column No. 6 by the total of Column No. 2, which is: 20,967 inch-pounds divided by 555 pounds. This gives us 37¾ inches back from the rear surface plate of the propeller hub.

To find the vertical location of the center of gravity, divide the total of Column No. 4 by the total of Column No. 2, which is: —1228 inch-pounds divided by 555 pounds or —2.21 inches. The minus sign (—) means that the measurement is below the thrust line.

The items and measurements listed in Table No. 1, are taken from the vest-pocket pursuit biplane called "The Knight Twister." In Figure No. 1, we have made a sketch of The Knight Twister in its level landing position. The center of gravity of each item is shown by a small dot. The horizontal measurements from the datum line to each item, as well as the vertical measurements, from the thrust line are also shown.

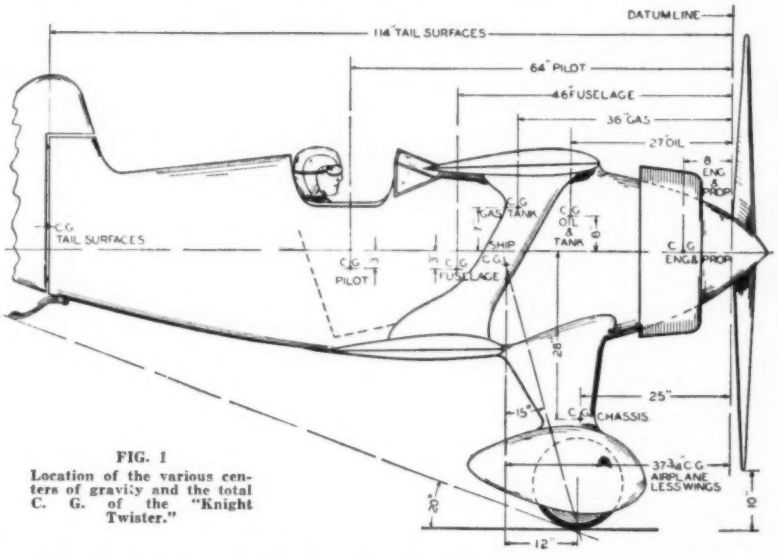


FIG. 1
Location of the various centers of gravity and the total C. G. of the "Knight Twister."

After the problem is worked out with results tabulated as in Table No. 1, the center of gravity of the ship is measured off on the drawing as in Figure No. 1. A vertical line is drawn from the center of gravity of the ship down to the ground line and from this point we show a measurement forward of 12 inches to the point of wheel contact with the ground. The angle formed by the vertical line, and a line from the center of gravity to the point of wheel contact with the ground, is 15 degrees. This angle can be from 12 to 17 degrees as shown in Figure No. 4.

The landing gear must be long enough to give the proper amount of propeller clearance, which is 10 inches when in the level landing position and to allow us to get at least 95 per cent of the maximum lift when in the three-point landing position. The angle of maximum lift of some wings is 18 degrees, but that of the M6 wing used here is 20 degrees. Some designers place the landing gear so that when the ship is in the three-point landing position, the wings are at the maximum lift angle. Others set the landing gear so the ship is at only 10 degrees. This small angle allows you to use a shorter landing gear, thereby saving a lot of parasitic resistance.

In the Knight Twister, the diameter of the propeller was the deciding factor in designing the landing gear. Sometimes the landing-gear is referred to as the "Chassis," as in Table No. 1. The landing-gear may need to be further forward when brakes are used, but the position shown has worked out very satisfactorily.

In Figure No. 4, two angles are shown—Angle (B) and Angle (A). Angle (B) is the angle formed by two lines that designate the ground lines at level landing and at three-point landing. The angle (A) locates the landing gear in relation to the C. G. In Figure No. 2, the angle (B) is 10 degrees and in Figure No. 3, the angle (B) is

TABLE No. 1. Tabulated Items of C. G. Calculation

1. Item	2. Weight	3. Vertical Arm	4. Vertical Moment	5. Horizontal Arm	6. Horizontal Moment
Engine and Propeller	180 lbs.	0 in.	0 in. lb.	8 in.	1440 in. lb.
Gas and Tank	70	7	490	36	2520
Oil and Tank	10	6	60	27	270
Pilot	170	—3	—510	64	10880
Chassis	37	—28	—1036	25	925
Fuselage	75	—3	—225	46	3450
Tail Surfaces	10	2	20	114	1140
Tail Skid	3	—9	—27	114	342
Totals	555 lbs.		—1228 in. lb.		20967 in. lb.

18 degrees. Maybe this Figure No. 3 has also given you a big laugh, but there is something else there besides a laugh.

We are told that the angle (B) should be sufficient to give an angle of at least 95 per cent of the maximum attack to the wings that will result in lift of whatever type of airfoil we use. For a Clark "Y" it would be 12 degrees, with an M6 would be 16½ degrees and a U. S. A. 40 wing-section would require 13½ degrees. If these wings were set on the fuselage at an angle of incidence to give the best lift-drag ratio, then the Clark "Y" would be set at 1 degree, the M6 set at 4 degrees and the U. S. A. 40 at —1 degree.

In Figure No. 2, we drew a wing with an angle of incidence of 4 degrees. Now if the required angle of attack to get 95 per cent of the maximum lift is 14 degrees, it means that the angle (B) will be 10 degrees, for 14 degrees it will be minus 4 degrees (angle of incidence) equals 10 degrees for angle (B). In Figure No. 3 we drew a wing with an angle of negative (—4) degrees incidence. If this wing had to have an angle of attack of 14 degrees, angle (B) would have to be 18 degrees; for 14 degrees, plus 4 degrees (angle of incidence) equals 18 degrees for Angle (B). Figure No. 3 is an exaggeration, but shows what happens to the length of the landing-gear struts when the angle (B) is increased.

Notice that in Figure No. 3, the Angle (A) is 15 degrees or the same as in Figure No. 2, but the wheels are further forward. That is, the distance measured from the vertical line dropped from the C. G. to the ground line to the point of wheel contact with the ground is more in Figure No. 3 than in Figure No. 2. Enlarging the angle (B) causes the wheel contact point to be moved forward, thereby making the landing-gear struts longer.

Figures Nos. 5-6-7 are the front views of Figures Nos. 2-3-4. Figure No. 7 shows two angles—angle (C) and angle (D). Angle (C) should not be less than 25 degrees. This angle is formed by a line dropped vertically from the center of gravity to the ground line, and a line from the center of gravity to the point of wheel contact with the ground. This angle (C) can be larger.

Angle (D) which, is formed by the ground line and a line drawn from the wing tip to the point of wheel contact with the ground, should not be less than 6 degrees and the wing or elevator tips should not drag on the ground with ailerons or elevators fully depressed.

In Figures Nos. 5-6, we drew the landing-gears with the Angle (C) equal 25 degrees which is the minimum angle allowed. Notice that in Figure No. 5, the spread between the wheel treads is much less than in Figure No. 6. The wider this spread the longer the landing-gear struts. One point that we are trying to get over is; the shorter the landing gear struts, the smaller amount of power consumed to drag the chassis through the air.

Figure No. 5 shows a very narrow spread to the landing-gear — most planes have it wider than this. Too wide a spread with a short fuselage will cause the ship to ground loop when one wheel strikes something on the ground. For a ship that is 20 feet overall length, the spread of the wheels could be 5-feet without any undue annoyance from ground looping.

In Figure No. 4, angle (A) and in Figure No. 7, angle (C), are both drawn from the center of gravity. If the center of gravity is high, the wheels will touch the ground further ahead and further apart.

In Figures Nos. 2-3-4-5-6-7 we used a long fuselage with a low-wing monoplane. With a short fuselage and a short-span biplane, the landing-gear may not have such long struts, as pictured in Figure No. 3. See Figure No. 1, the side view of the Knight Twister which has an angle (B) of 20 degrees. This angle can be smaller with a smaller diameter propeller.

If you prefer a wire-braced chassis instead of a mono-strut type, it could be designed to have less resistance for the large mono-strut does cause quite a large ripple in the slip-stream. Of course, a retractable landing-gear solves a lot of these difficulties with wind resistance, but it is hard to find room in a small fuselage.

We see that certain items are entirely dependent upon personal judgment and preferences. If it were not for this condition, there would be no point to start from. After choosing the type of wing bracing, type of landing gear and the type of fuselage, we then move things around until they all match up according to the rules given here.

After the C. G. and landing gear details are adopted, then we must check up locations with the requirements for the propeller clearances. This means that we must go back to the power plant and work out the probable propeller diameter before we can safely adopt any given height of landing gear.

The propellers in a two-engine job should clear the fuselage by 6 inches. The propeller on a seaplane should clear the water by at least 18 inches and clear the floats by not less than 2 inches.

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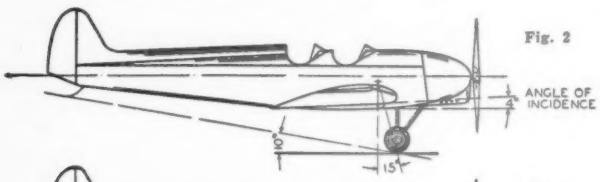


Fig. 2

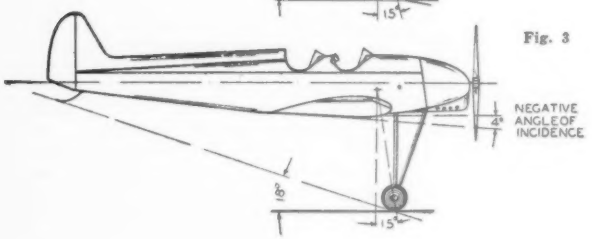


Fig. 3

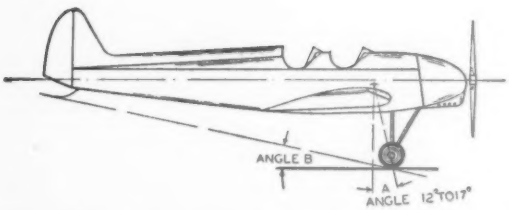


Fig. 4

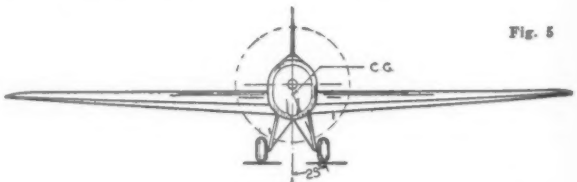


Fig. 5

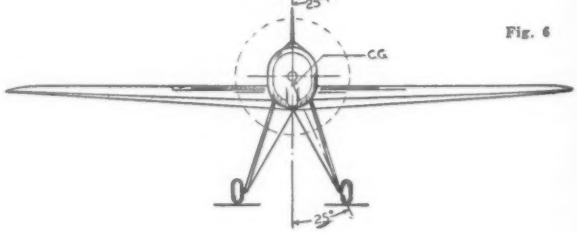


Fig. 6

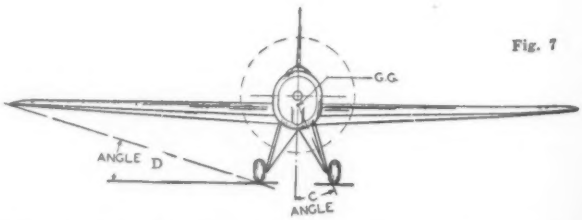


Fig. 7

Diagrams at left show the relation between the landing gear height, the length of fuselage and the advance of the wheels in front of the C. G. At the right are diagrams showing the relation between the landing gear height, span and tread.

Adjusting Lightplane Controls

by F. NAGLE

Pertinent notes on the proper adjustment of the controls and test flights of a lightplane, particularly with reference to the first test hops with a new plane.

AND now let us look into the stabilizer problem. Within limits, this adjustment can be made to remedy tail or nose heaviness—but only within limits as a stabilizer placed at an acute angle causes excessive drag.

If the ship is provided with an adjustable stabilizer, the job is easy. However, if the stabilizer has no such adjustment, it can be regulated by placing shims above or below the leading edge or by placing washers between the fitting and the mounting.

Now it may be, as in the case of one lightplane the author observed, that the unbalance of the plane (in this case nose heaviness) is so great that even with stabilizer the adjustments cannot be made. The pilot with the stick way back cannot get the tail down for landing unless he uses the engine to blow it down. Here, the best thing to do, is to change the basic design and shift the center of gravity so that the unbalance is not so great. As a makeshift measure, weight the tail with enough weight so that some semblance of balance is obtained.

Merely increasing the angle of the stabilizer in this case is not good. When the engine is shut down for landing, the slip-stream is gone and the elevator, not having air going by it at high velocity, has less effect and nose-heaviness again recurs.

Also observe during this series of low flights, the position of the control stick in level flight. It should be in the center. If far off to either side, the lengths of the control cable should be altered so that the stick is in the center with normal flight.

Now assuming that no longitudinal unbalance is found, and that the control stick is sufficiently in the center for complete freedom of movement, run the plane back to the end of the field and make another hop. The first hop has shown you that the airplane can fly. (We hope.) Now, attempt to observe a few more of its characteristics.

Try the aileron controls and see how the up-and-down movement of the wings reacts to the stick movements. Are the controls sluggish or prompt? Try up and down elevator, not so much to bring the plane to the ground as to get an idea of the effectiveness of the control. Observe, when putting the plane down for the landing, any peculiarities it may exhibit in the stalled position, such as a tendency to drop quickly or to fall off on one wing.

If the aileron control is found deficient, the ailerons should be made larger by making them longer or wider. If the plane is too heavy for its wing area and flies near the stalling angle, aileron control if deficient, can be improved by raising the ailerons with respect to the wing. This is a decided improvement and should be tried.

Look over every element of the controls carefully, in the cockpit as well as elsewhere.

Continue to make these short hops till you have learned the characteristics of the plane and have adjusted it to good balance and controllability. It may be tiresome, but it is better than getting off the field and having to land in somebody's potato patch because something goes wrong.

Suppose that these flights have been made and everything found to be working well. A real flight can now be made. Procure a parachute for this. Take off and climb till you reach a good altitude—at least 3,000 feet. Now you can try turns and stalls, side-slips and wing-overs. See how the airplane reacts in a stall, but be sure to catch the stall before the plane whips into a spin. Find out if it tends to snap into a spin easily. If it does, remember to guard against letting the speed of the airplane drop near to stalling speed when in flight.

During these runs, note at what angle the airplane glides with throttle closed. This can be checked later more accurately by means of an airspeed meter, altimeter or stop watch if desired. Next, make some landings and learn more fully the airplane's characteristics in this respect.

If these tests have proven the stability and structural strength of the design, you can go further depending on how strong your design is and the maneuvering qualities of the plane. Don't, however, attempt stunts above the performance of your airplane.

If you wish, you can deliberately put your plane into a spin to test this quality. This test is not absolutely necessary and is not advised unless the possible consequences are kept well in mind when attempting this maneuver with a new design of airplane. Go up plenty high, about 5,000 feet. Make sure your plane is not tail-heavy before you go up for this test. It should preferably be slightly nose heavy to insure recovery.

Some planes are hard to put into spins, but the following procedure is usually effective. In level flight, throttle the engine and pull back on the stick till the plane is climbing at about a 45° angle. The plane now will soon reach the stalling speed. With the plane in this attitude, pull the stick all the way back and keep it back, kicking full rudder in the direction in which it is desired to spin. Hold the rudder there. If this does not put the airplane into a spin, a severe skid on a normal turn with power on and back stick will most certainly put it in. This method is not recommended, however, as it strains the airplane, and if power is left on, may precipitate the airplane into a flat spin.

With the airplane in the spin for the first time, let it remain there a fraction of a turn and then bring it out. If all seems right, it can be left in longer next time. However, you should realize that maybe your plane might not readily come out of a spin and the longer it is left "in," the more difficult recovery becomes. If it shows a tendency toward difficult recovery, do not persist in your test of continued spins.

Because of the many different aspects of spin testing, it is advised most sincerely that only very experienced pilots attempt this stage of testing.

Interesting performance features of your plane can be noted also. By means of a watch and an altimeter, you can check the rate of climb. Along a measured distance on the ground you can check the air speed. The methods of accomplishing these tests can be found in some books on flying. Accurate measurement by instruments is the only sure method to pursue.

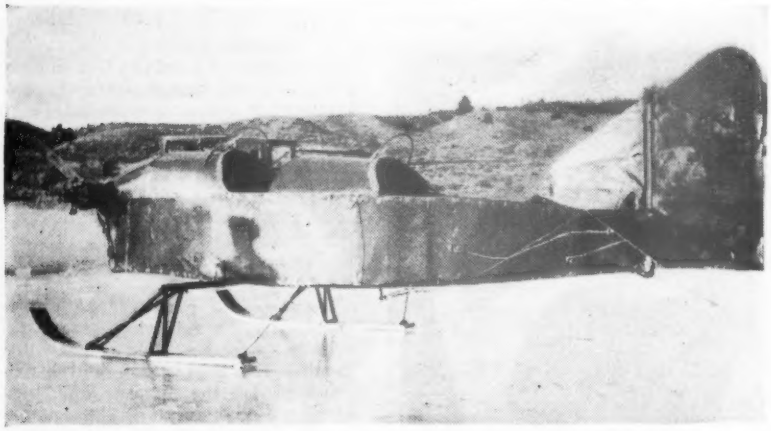
However, these are interesting refinements of the test of the flying ability of the airplane. The main thing is to be sure you have an airplane left after you have started to fly it. Remember, when you know there is something wrong with your airplane, don't make further test hops. *Fix it first.*

END.

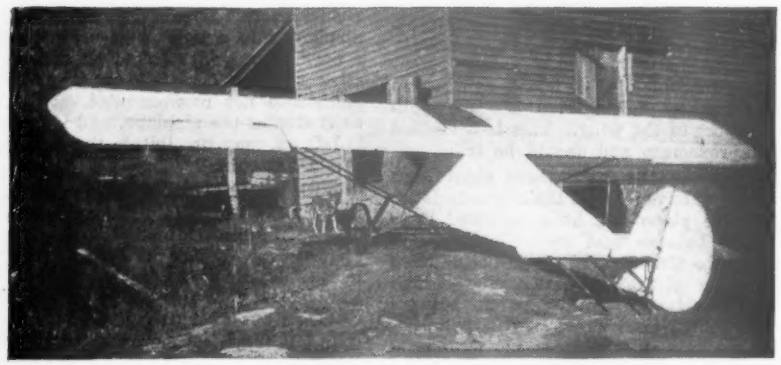
What Our Readers Are Building

A department devoted to our readers' activities in airplane, glider and engine construction, showing the latest developments.

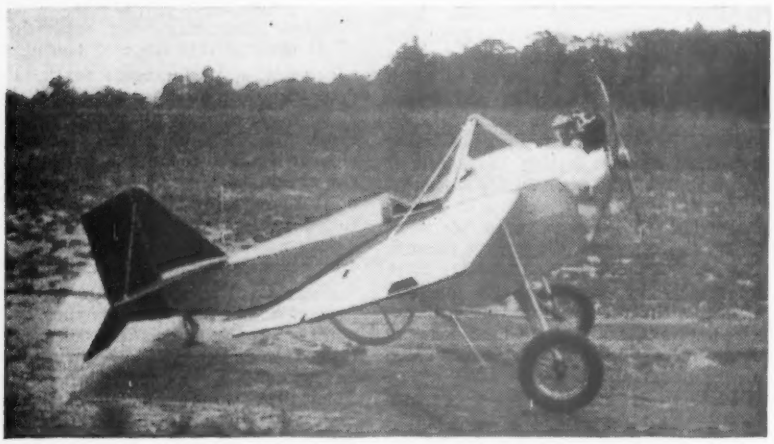
A Few of Our Readers' Productions Illustrated



This is the airplane type snow-sled developed and built by Lay Brothers Aircraft, Helena, Mont. They claim that it is the simplest and most practicable form of air-sled and these boys have been experimenting a long time.



An ALCO sportplane built by L. G. Tucker, Jr., 20 Logan Court, Raleigh, N. C. It's all complete but the engine and the builder is looking for one of 30 to 50 h.p.



This hedge-hopper, built by Jack C. Harkness, 162 W. Palisade Ave., Englewood, N. J., is the successor of an earlier hopper by the same author that was published in the January, 1933, issue of P. A. He has given up the one wheel idea.

Let's Read About 'em

GENTLEMEN: we have with us, this evening, three mighty good looking jobs, built by three of our readers, that we are proud to show. They comprise a snow-sled, a monoplane and a hedgehopper. This fills the bill very well.

Now, at the top of the column, is the fuselage type snow-sled built by the Lay Brothers which they claim is easy and inexpensive to build. They have been experimenting since 1920, and the present model is the culmination of these efforts.

It is built of light gauge sheet metal over a wooden frame. They use a motorcycle engine. The controls are the conventional rudder-bar and stick type which give excellent training in the operation of the rudders and elevators. No wings are used. It has been timed at 65 m.p.h. with an Excelsior motorcycle engine installed.

Next, upon the program, is the natty little ALCO monoplane constructed by L. G. Tucker, Jr. Built of wood and plywood, he claims that it does not weigh over 200 pounds (without the engine) and it has received the O.K. of several aero engineers who have inspected the job. The span is 27 feet 6 inches, length 18 feet 0 inches and height about 6 feet 0 inches.

It is built as a 1-seat cabin job having the cabin enclosed with pyrolin.

About one year ago, Jack C. Harkness sent us a photograph of a monowheel hedge-hopper that he had built. And now, we are happy to show the improved descendent of the original ship which has undergone a number of important changes.

The one-wheel idea did not work out very well because the outrigger skids are useless at 15 to 20 m.p.h. which is too slow for the ailerons to become effective. Hence the present two-wheel type which was built on telescopic struts of the hydraulic type. Connected through the fuselage, this permits the ship to bank over while running on two wheels.

Her performance as a ground trainer is good. She taxies nicely and goes buzzing down the field at about 30 to 35 miles per hour. She provides plenty of tricks to keep a fledgling busy—in fact she gives an experienced pilot all he wants to handle—and some more besides.

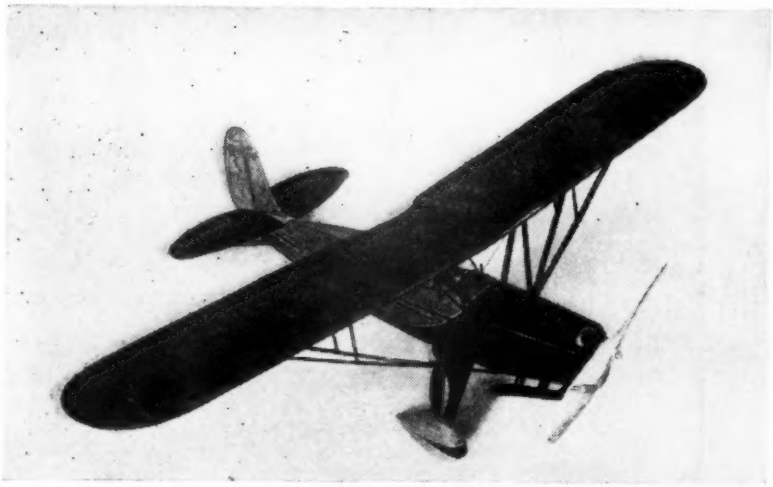
But—he had some hard luck. A friend of Jack's tried to take her off after racing her down-wind. The rudder was too effective for his skill and the result was a ground loop and over on her back she went. Too bad, but they will be back at it as soon as the busted longeron, busted prop and bent engine shaft are fixed.

Building the Fairchild "22"

by

PAUL W. LINDBERG

Commercial model designer and authority on model building.



Here is the completed model of the Fairchild "22" which will well repay the time spent building it because of its neat appearance and excellent flying qualities.

THIS little high-wing Fairchild has smart clean lines, but we had some time trying to overcome the usual stalling tendency of high-wing models before we got her to perking along. And now that all of this experimental work is over, we can assure you that you will have excellent results if you follow the plans carefully.

At our laboratory, we have obtained excellent flights with the "22," from 100 to 150 feet in length and at about 40 feet altitude. She's mighty fast, and when the rubber turns are exhausted, she flattens out and starts a graceful glide that terminates in a three-point landing.

Much of this fine performance can be charged up to the adjustable control surfaces, mounted on aluminum hinges, so that any desired adjustment can be given to them. Another point is the fact that no motor stick is necessary and this helps it fly better.

In building the model of the Fairchild "22," all dimensions can be quickly and accurately determined by placing a ruler on the part to be measured as the plan is printed full size. If you wish a larger model, multiply this measurement by the amount of increase. The color scheme can be obtained from the cover of the November issue of POPULAR AVIATION.

CONSTRUCTION OF FUSELAGE

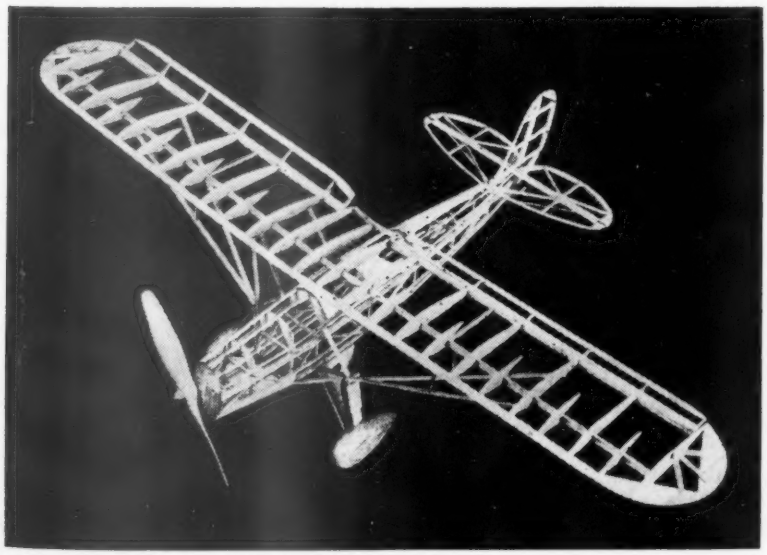
Place a sheet of ordinary wax paper over the plan to prevent frame from sticking to it. The fuselage sides are built from $\frac{1}{8}$ inch sq. balsa upon the plan.

The longerons, vertical and diagonal braces, etc., are held in place until securely cemented by inserting straight pins on either side of strips wherever needed.

After the two sides are completed, they are pinned to the top of the plan in such a manner that the top longerons face down, and the sides form right angles with the surface of the plan. The cross members are now cemented in their proper locations.

Cut formers from 1/32 inch sheet balsa and cement in their respective positions as shown on the plan. Form nose piece and drill a ¼ inch hole to receive nose plug. The 1/32 x $\frac{1}{8}$ inch stringers are now cemented to the outer edges of the formers. Notch only formers 3, 4, and 5 for receiving stiff paper used for cockpit cowling.

Section of fuselage from former 2 to nose-piece, is covered with stiff paper in four separate pieces,—top, bottom and two sides. Top and bottom pieces are applied to fuselage so that you can cover with tissue. The two side cowls are left open at rear to form air passages similar to those on the large ship.



This is the completed structure of the Fairchild "22" ready for covering. Note the use of sub-ribs in the wing construction and the adjustable ailerons.

LANDING-GEAR

All parts of the landing-gear are made of strong balsa and are streamlined.

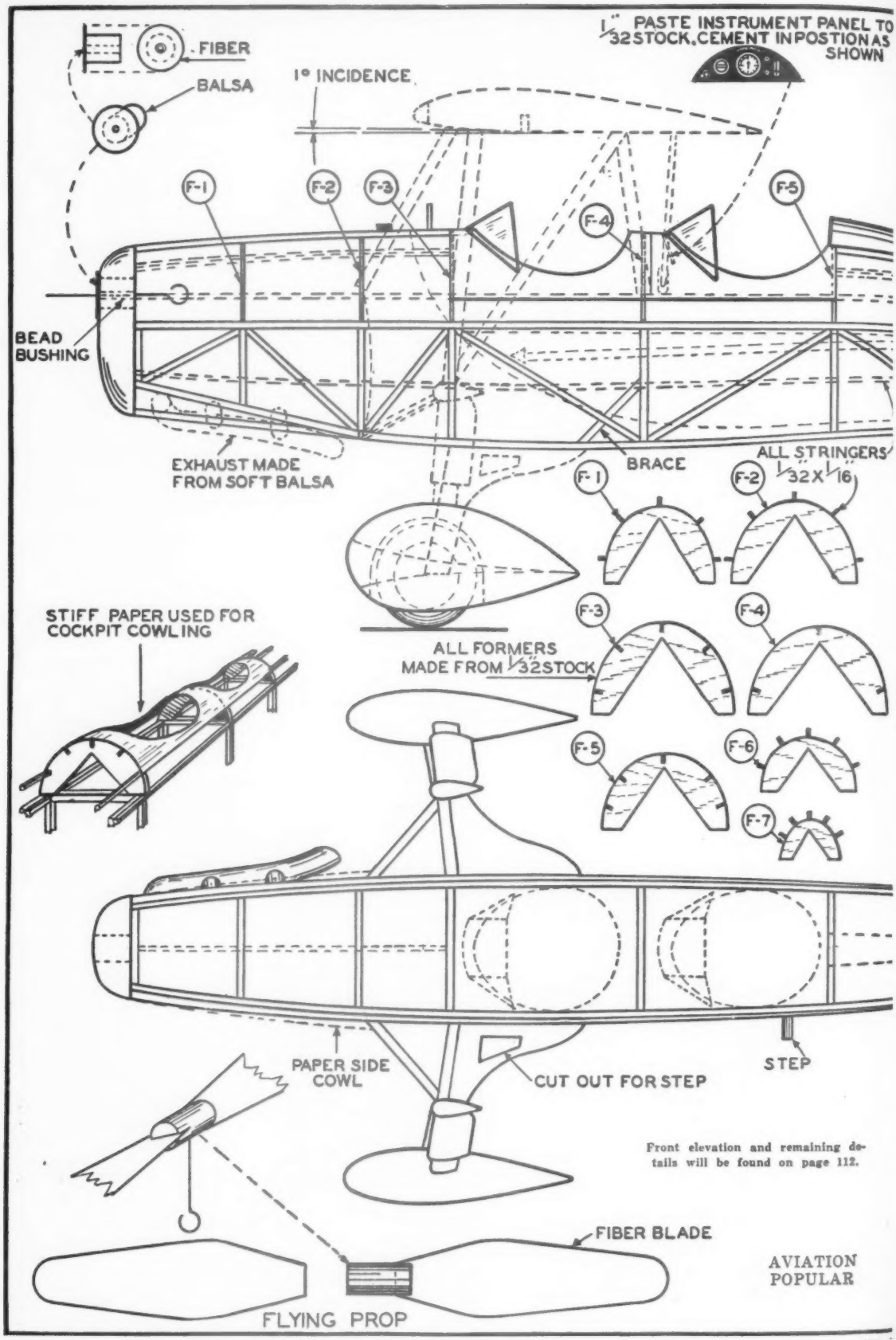
Extreme care should be taken in cementing the landing-gear to the fuselage. It is very important that the small brace shown in fuselage is not overlooked as this absorbs the shock of impact on landing.

There should be no trouble in constructing the streamline wheel coverings, as this is clearly shown on the plan. After these have been shaped and sanded, fit ¾ inch wheels into them, using a pin as an axle.

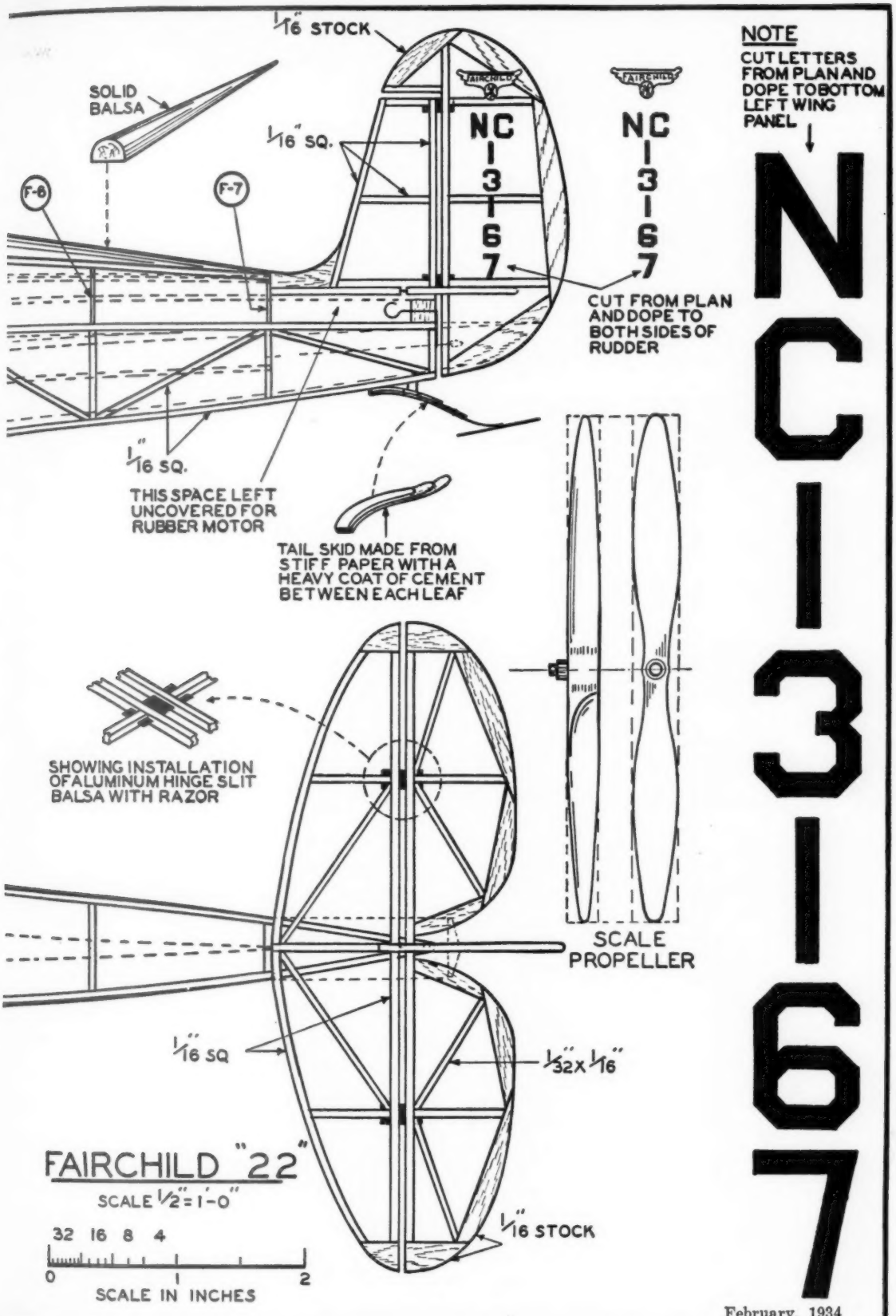
CONSTRUCTION OF THE WING

The wing is constructed in two separate panels. Cut all ribs from 1/32 inch sheet balsa. Lay a sheet of wax paper on plan and pin leading and trailing edges and center spar in position. The

(*Concluded on page* 116)



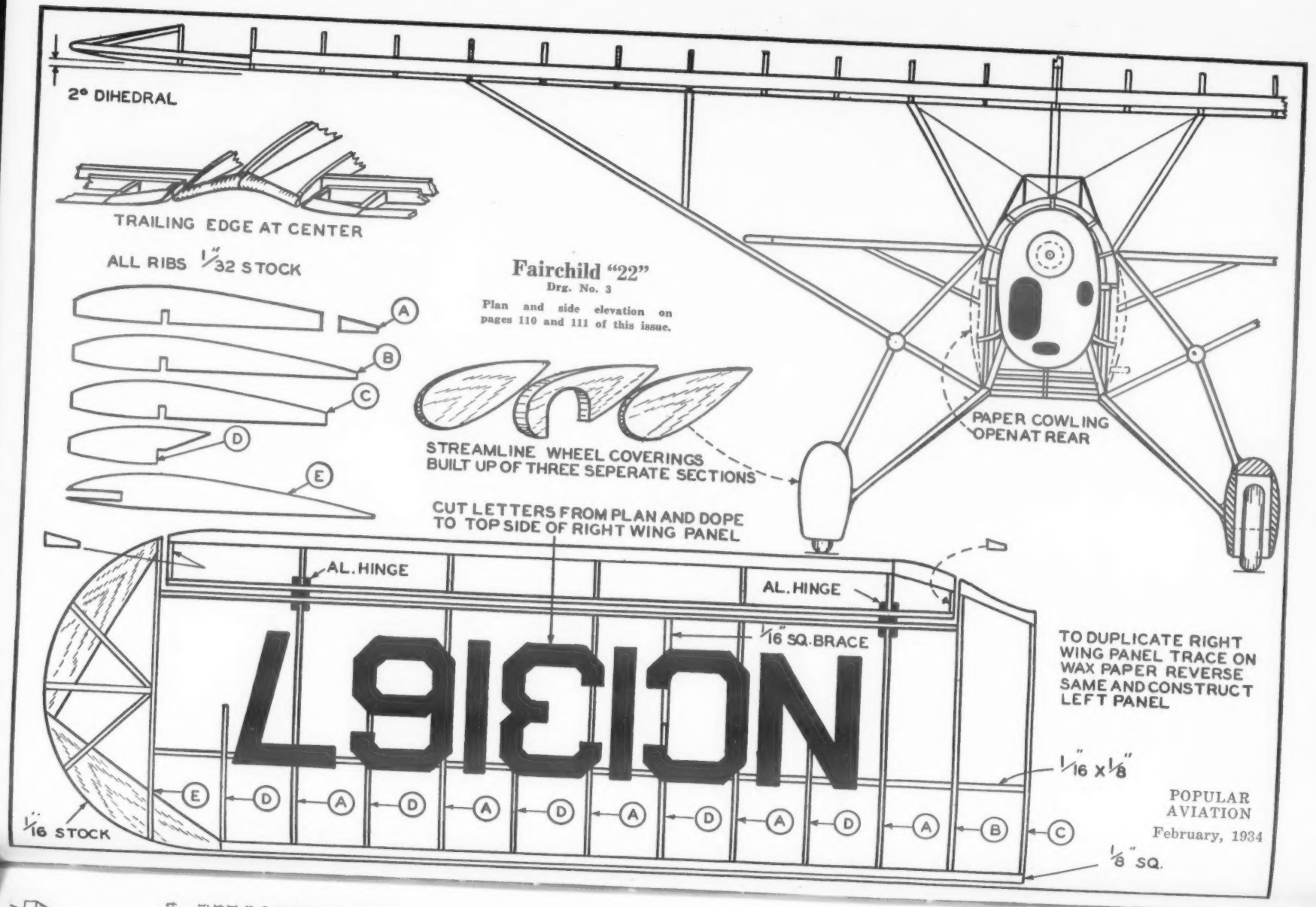
Front elevation and remaining details will be found on page 112.



NOTE
CUT LETTERS FROM PLAN AND DOPE TO BOTTOM LEFT WING PANEL

NC-3-67

February, 1934

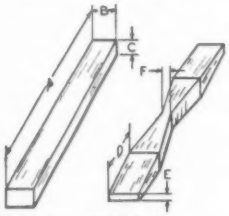

2° DIHEDRAL
TRAILING EDGE AT CENTER
ALL RIBS 1/32 STOCK
A
B
C
D
E
Fairchild "22"
Drg. No. 3
Plan and side elevation on pages 110 and 111 of this issue.
STREAMLINE WHEEL COVERINGS BUILT UP OF THREE SEPERATE SECTIONS
PAPER COWLING OPEN AT REAR
CUT LETTERS FROM PLAN AND DOPE TO TOP SIDE OF RIGHT WING PANEL
AL. HINGE
AL. HINGE
1/16 SQ. BRACE
TO DUPLICATE RIGHT WING PANEL TRACE ON WAX PAPER REVERSE SAME AND CONSTRUCT LEFT PANEL
1/16 x 1/8
1/16 STOCK
1/8 SQ.

Making Model Propellers

by P. W. LINDBERG

PERHAPS the least understood of all operations in successful model airplane construction is the production of a propeller, which is both effective and realistic in appearance. At least we may be safe in saying this particular operation has more diversified and so-called "fool-proof" methods than that of any other part of the model.

We have made an extensive study of the various better known methods and have found what we believe is the simplest and best. It is a "blanked-out" proposition which is so designed



LOW PITCH

A	B	C	D	E	F	Pitch
4"	1/2"	1/4"	1"	1/8"	1/8"	3.01"
5"	1/2"	1/4"	1 1/4"	1/8"	1/8"	3.76"
6"	5/8"	5/8"	1 1/2"	3/16"	1/8"	5.46"
7"	3/4"	1/2"	1 3/4"	1/4"	1/4"	7.32"
8"	7/8"	5/8"	2"	5/16"	1/4"	8.95"
9"	1"	3/4"	2 1/4"	3/8"	1/4"	10.45"
10"	1 1/4"	7/8"	2 1/2"	7/16"	5/16"	12.05"
11"	1 1/4"	1"	2 3/4"	1/2"	5/16"	13.81"
12"	1 3/8"	1 1/8"	3"	9/16"	5/16"	15.40"

MEDIUM PITCH

A	B	C	D	E	F	Pitch
4"	1/2"	3/8"	1"	3/16"	1/8"	4.52"
5"	1/2"	3/8"	1 1/4"	3/16"	1/8"	5.65"
6"	5/8"	1/2"	1 1/2"	1/4"	1/8"	7.59"
7"	3/4"	5/8"	1 3/4"	5/16"	1/4"	9.08"
8"	7/8"	3/4"	2"	3/8"	1/4"	10.68"
9"	1"	7/8"	2 1/4"	7/16"	1/4"	12.15"
10"	1 1/4"	1"	2 1/2"	1/2"	5/16"	14.01"
11"	1 1/4"	1 1/8"	2 3/4"	9/16"	5/16"	15.47"
12"	1 3/8"	1 1/4"	3"	5/8"	5/16"	17.05"

HIGH PITCH

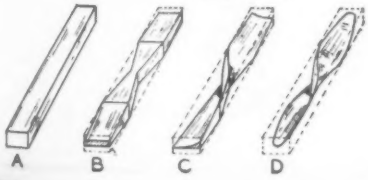
A	B	C	D	E	F	Pitch
4"	1/2"	1/2"	1"	1/4"	1/8"	6.28"
5"	1/2"	1/2"	1 1/4"	1/4"	1/8"	7.85"
6"	5/8"	5/8"	1 1/2"	5/16"	1/8"	9.42"
7"	3/4"	3/4"	1 3/4"	3/8"	1/4"	10.84"
8"	7/8"	7/8"	2"	7/16"	1/4"	12.41"
9"	1"	1"	2 1/4"	1/2"	1/4"	14.13"
10"	1 1/4"	1 1/4"	2 1/2"	9/16"	5/16"	15.70"
11"	1 1/4"	1 1/4"	2 3/4"	5/8"	5/16"	17.10"
12"	1 3/8"	1 3/8"	3"	11/16"	5/16"	18.70"

as to eliminate guess work entirely in obtaining any desired pitch in the propeller.

Mathematical formulae are the hardest thing in the world for most amateurs to remember, therefore this illustrated chart method, which practically does away with complicated figuring should be of help. After selecting a propeller of the correct size and pitch for your model, cut out blank as shown in STEP I.

In STEP II, the outline shape of the propeller blank is clearly shown.

(*Concluded on page* 120)



This Gasoline Driven Model Breaks Record

The Bunch Brothers' gasoline engined model plane is a tremendous affair compared with the largest rubber driven types. Recently, it flew for 26 minutes, the record for this type of model.

THIS gasoline powered model was constructed by the Bunch brothers, Los Angeles, Cal. It has a wing span of 10 feet and is powered with a 0.4 h.p. gasoline engine of the 1-cylinder, 2-cycle type.

The gasoline tank holds seven ounces of gasoline which is sufficient for 45 minutes flying. The throttle, however, is clock controlled so that any desired duration may be had by making the proper adjustments. The total weight of the model is eight pounds and it has a top speed of 30 miles per hour.

The Judges Are Busy in P. A.'s Model Contest

THESE are busy days in P. A.'s offices and for the judges of the P. A. Second International Model Airplane Contest.

To carefully and critically examine each photographic entry, usually with a magnifying glass, is no small undertaking when the number of photographs submitted runs up into the thousands. The poor judges who volunteered their services for this job are getting plenty of work—but then there is a lot of fun connected with the job after all.

Of course, some of the photographs show a model so obviously out of the running that they need very little attention after the first glance, but then there are so many very excellent examples that it takes a lot of study to make a selection. So far as we have gone into the matter at this stage of the game, it seems as if the models submitted this year are much better, as a whole, than those in last year's entries.

At present, we have no idea as to how many models are entered because we have not had an opportunity to count them, but judging from the space that they occupy, we should say that the number of entries is a record beater. In the first place, we sent out more than 5,500 full size plans but this is not an index as many did not use these plans but purchased kit sets or plans from their dealers, while others drew their own plans.

In spite of the fact that the models are all models of one ship, the Boeing 247, there is a great diversity among the models themselves. Some are flying models, others are non-flying models and there is a great difference in each classification in respect to the amount of detail shown. When this contest started, some months ago, we were promised a number of all-metal models, but so far, we have not run across any photographs of these models. We are still a long way from reaching the bottom of the pile, however, and they may turn up yet.

There are a number of models carved out of the solid wood, probably the great majority are of this type, among the non-flyers. Built up non-flyers are in the minority.

But this is not the end of our job. After the winning photographs have been selected, we will send for these models, and then the arguments will start all over again. Which will be first, second, third or fourth, etc., is always a hectic decision to make. But whoever wins, will get a worthy prize —we'll promise that.

A Model Stratospheric Balloon

by HOWARD MAGILL

Here is a model that will give you real distance, duration and altitude. It is a simple hot-air or Montgolfier balloon that is easy to make and which has an excellent performance.

SINCE Lieut. Commander Settle's successful flight into the stratosphere, we have had many requests from our model builders for a good model balloon—so here she is.

Now, while Settle's balloon employed hydrogen as a lifting gas, we must turn to something simpler because it takes mighty good workmanship and a lot of experience to make a balloon tight enough to hold the thin leaky hydrogen. Therefore, we will fall back on the good old reliable bag of hot air to do the trick, called the "Montgolfier" balloon. Buoyancy is provided by heating the air in the balloon by a small torch, and while this would never reach the stratosphere, yet it will give you a several mile chase when you try to catch it.

Since certain elements of this balloon are of practically the same weight, there is a decided limit to the size of the balloon, the minimum or least diameter being about 22 inches. Twice this diameter would be much better. A balloon of about four feet in diameter is easier to make, has more lifting power and rises higher than a smaller balloon. The drawing shows a 22 inch balloon, the size of the first experimental model, but I recommend 44 inches or 48 inches as being a more practical size. You don't need to be so careful with the weight when building the big balloon and it will fly further. The 22 inch balloon will lift only 1½ ounce total while the 44 inch balloon will lift eight times as much, or 12 ounces, total.

The "fabric" for the bag will be model airplane tissue or very thin strong tissue paper. The 22 inch model will require 18 square feet while the large balloon will use 72 square feet of the paper. By carefully following the drawing and the text, you can easily construct the most difficult part —the bag or "envelope" of the balloon.

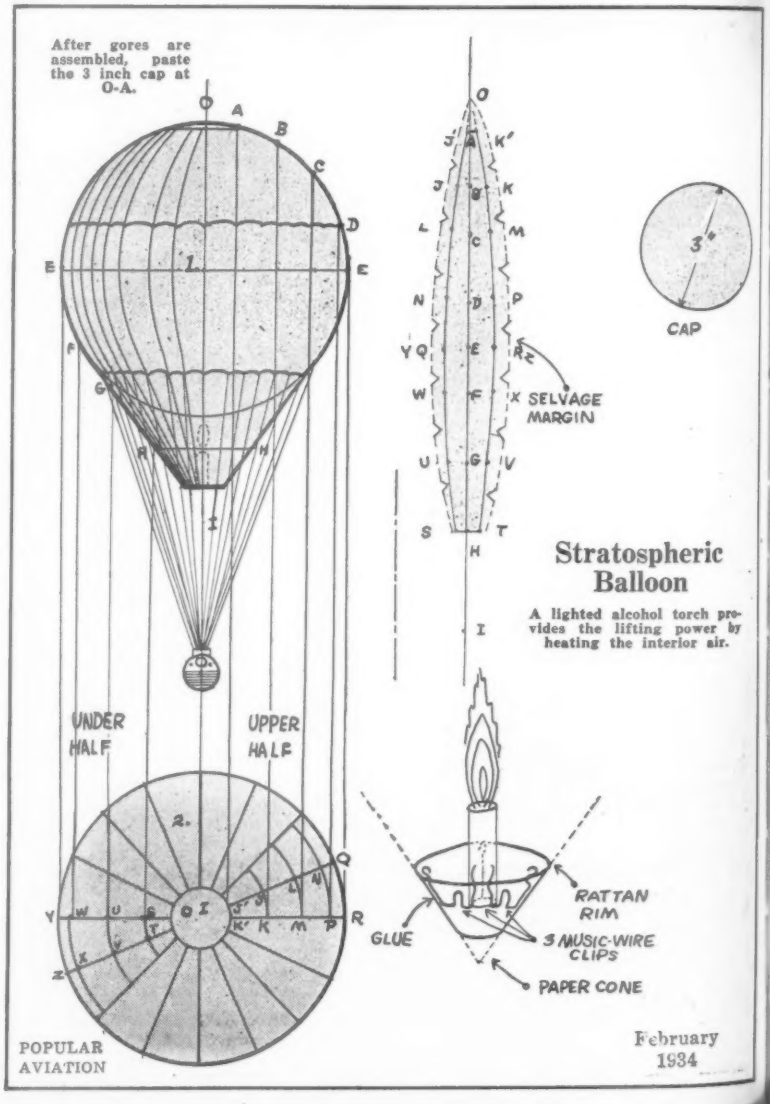
To build the spherical envelope it will be necessary to divide it into a number of sections or long tapered "gores" which are cemented together at their edges. To get these sections properly cut is the main problem before us. The greater the number of gores or sections, the more nearly spherical will be the balloon, but to save work we will limit the number to 16. When you become more proficient at the job, you can increase the number to 40 gores or more.

In geometrical phraseology, the form of the gore is a "lune." To layout these lunes, get a smooth piece of wrapping paper and draw two identical circles a foot or more apart, the diameter of the circles being equal to the desired diameter of the balloon. Draw a line connecting their centers. On this line, between the circles, mark a point outside one of the circles equal to half the radius. Through this point draw a line tangent to the circle giving the outline of the balloon as shown. The remaining circle will be the "plan" or top view of the balloon.

Divide the plan circle into as many sections as you wish, but we recommend that you use sixteen divisions for this first job. Divide the right upper curve of the side view into five equal parts as at O, A, B, C, D, E as shown in the drawing. Next, divide the lower left portion into three equal parts as E, F, G, H. The portion H-I need not be considered now as it is formed by a separate paper cone, a part of the heating unit.

From these points, drop parallel lines down to the line connecting the centers and passing through the circle as at ER, CM, GU, etc. Using the same center, strike off arcs through one or more of the sections tangent to these lines such as QR, NP, WX, etc. Now, off to one side or on another piece of paper, draw a long straight line, and with a ruler or a piece of string, mark off the distances OA, AB, BC, etc., on

(*Concluded on page* 123)



What the Industry is Doing

Latest bulletins from the airplane, engine, equipment manufacturers and dealers boiled down into a nutshell. Contributions to this department are invited.

Commander Byrd has installed Smith Controllable Pitch propellers on his Antarctic Condor plane.

A NEW SAFETY RECORD has been established by the air-passenger lines of the United States. There were only two pilot and two passenger fatalities during the first half of 1933, during which time the transport planes flew a total of 76,642,393 passenger miles. By the laws of averages, a passenger can therefore fly 38,321,198 miles before meeting with a fatal accident.

KINNER AIRPLANE & MOTOR CORP., Glendale, Calif., have just introduced a 2-place convertible plane for the sportsman pilot. It has received its A.T.C. from the Department of Commerce and delivery of the first of the type has been made to Dr. Ross Southerland, a California physician, who intends to use it for professional calls throughout the state.

PARKS AIR COLLEGE, INC., Parks Airport, East St. Louis, Ill., has issued a very comprehensive 20-page pamphlet "Outline of Courses" that will be of great interest to intending students of aviation. Much useful information on the subject of aeronautical education, in addition to data on the Parks Courses, will be found in this book, and there is a complete description of the new Parks Course in Aeronautical Engineering which is very complete and well worth while.

The Crosley home or office A. C. radio receiver, especially adapted for airplane signals. Will receive both broadcast band and short-waves.

THE WACO AIRCRAFT COMPANY, Troy, Ohio, has issued an operating statement covering the first nine months of 1933. The net sales for nine months ending September, 1933, amounted to $810,986.67 with a net manufacturing profit of $239,451.91.

THE SPERRYSCOPE, Vol. 7, No. 2, a publication of the Sperry Gyroscope Company, New York, contains much information of interest in regard to aerial navigation instruments. There is an excellent description of the Sperry pilot used by Wiley Post on his 'round the world flight and new lights on the epochal flights of Balbo and the Mollisons.

WESTPORT MANUFACTURING CO., 1114 S. San Fernando Road, Glendale, Calif., are producing a popular aircraft radio receiver, the Westport AR62T that covers the entire band of 200 to 525 kilocycles (1500 to 570 meters) used by the Department of Commerce for weather broadcasts and radio range beacons. This model is provided with precision remote control tuning mechanism.

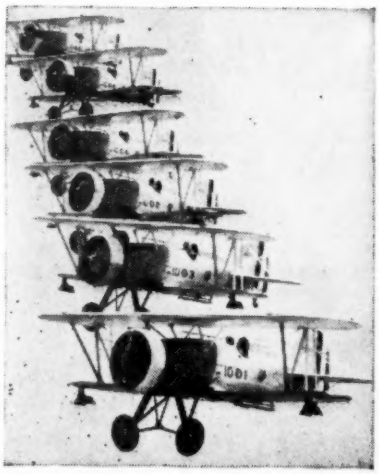
COMMAND-AIRE INDUSTRIES, INC., Little Rock, Ark., Municipal Airport, will do airplane repair work, and manufacture aviation products, including specially designed airplanes. They are operating in the old Command-Aire factory, and though they have been doing repair work, to date, intend to build a light sport model plane (2-place) to sell at $1,000. The plane and engine will be designed by Mr. Voellmecke, the president, who claims that they will be unlike anything yet produced in America.

THE SKYLARK CORPORATION, Muskegon, Mich., recently purchased the assets of the Driggs Aircraft Corporation, Lansing, Mich., and Pierson's Flying School, Belmont, moving the latter to the Muskegon County Airport.

It is their intention to continue the manufacture of the Skylark plane, a 2-place open biplane equipped either with the Rover Inverted or the Cirrus Hi-Drive engine. The officers of the new company are: Paul B. Kilmer, Pres.; E. Norman, Vice-Pres,; Roland Pierson, Secy.; B. H. Seydell, Treasurer.

AN INTERNATIONAL RECORD for large scale long distance transport operation was claimed by United Air Lines last month with the completion of 99.44 per cent of a scheduled 2,803,000 miles of flight during the past six months. This was on the 2,000 mile Chicago-California division of the coast-to-coast airway.

A GAIN of 121 per cent in business for October, 1933, was reported by the air service of the Railway Express Agency. All branches of airline service, passengers, mail and express showed indications for a sharp upturn in the immediate future.



A group of the recently delivered Boeing F4B-4's flying in "right Echelon."

BYRD uses Smith Controllable Pitch Propellers on his Curtiss-Wright Condor plane which he is to use for his exploration flights over the South Pole. The ability of shortening the take-off distance by use of these propellers, while in the rough polar regions, is a matter of great importance.

BILLY PARKER, head of the aviation section of Phillips Petroleum Company, Bartlesville, Okla., has two complete radio receivers in his Lockheed Orion. To liven up the hours while flying, he has a direct control Westport broadcast receiver by which music and other broadcast features can be tuned in. The second Westport receiver, installed in the rear of the fuselage with remote control, is used for "riding the beam" and for receiving weather reports.

IMPERIAL AIRWAYS, LTD., Airway Terminus, Victoria Station, London, S. W. I., has just issued the report of its annual general

Leroy Gregg, flight instructor at the Boeing School of Aeronautics, who has soloed 300 students without an accident. He has taught flying for 18 years.

meeting. The Right Honorable Sir Eric Geddes, the chairman, announces that the gross profit has increased from 152,797 to 266,150 pounds Sterling, and recommends the payment of a 5 per cent dividend. The capacity of the service operating in Europe has been increased 37 per cent during the past year.

BOEING SCHOOL OF AERONAUTICS, Oakland, Calif., has announced its Fifth Annual Scholarship Competition that represents a tuition value of $7,500. Undergraduates of the Boeing School are eligible to compete in the contest. The competition will close April 1, 1934.

Another item of interest from this school is to the effect that Flight Instructor LeRoy Gregg has just soloed his 300th student without a single mishap. Gregg, who has more than 6,000 hours in the air to his credit, has taught flying for 18 years and joined the staff of Boeing School of Aeronautics in 1929.

THE CROSLEY AIR ROAMIO is a new lightweight radio receiver that can be installed in any type plane. Its frequency range includes beacon and meteorological broadcast channels and also the standard broadcast band of 540-1700 kilocycles. The two ranges may be exchanged by simply turning a single switch. Any number of headphones can be attached to accommodate extra passengers. One of the outstanding features of the new Crosley Air Roamio, is the exclusive Synchronode Power unit. This is the first plate supply that does not employ tubes, bearings, brushes or other high-speed parts.

IN addition to the airplane radio, the Crosley Radio Corp., has also produced a new airplane signal receiver for the ground stations. This is a 7-tube superheterodyne suitable for airports, the private home or for the official airline offices. It also has a dual frequency range for airplane communication or for the broadcast band.

HEE LOW, formerly of Canton, China, has enrolled at the Ryan School of Aeronautics, Lindbergh Field, San Diego, Calif., for mechanical training, preparatory to his return to China where he expects to continue his aeronautical activities. Nine students and pilots from the Ryan school participated in the Southern California Sportsmens' Air Tour to Ensenada, Mexico. The flight was made in Great Lakes planes, this student body being the largest group in the 117 entries in the race.

AIRPORTS AND AIRPLANE PLANTS will be interested in the Commercial Utility Crane which is now available for the Model 20 and 25 Cletrac tractors, produced by The Cleveland Tractor Company, Cleveland, Ohio. The boom is of the goose-neck type which makes it possible for the crane to pick up airplane engines or other materials that would interfere with the common type of boom.

UNITED AIR LINES, by straightening out the New York-Chicago-Pacific Coast airway, on which it flies 6,000,000 miles per year, has reduced the length of the route to 2,725 miles. The airway distance between New York and California is now 400 miles shorter than by rail and 600 miles shorter than by the most direct coast-to-coast automobile highway. United flies coast-to-coast in 20 hours.

MRS. ASHMUSEN, widow of the pioneer pilot and aviation engine designer, has announced her intention of disposing of the patents, tools, jigs and fixtures, employed for building the Ashmusen engine which was invented and designed by her husband. This novel engine, which has been under development for many years is well deserving of investigation by interested parties.

A FINE AIRWAY MAP of Florida, which when extended becomes a strip map of 11 by 34 inches, can be had free from the State Road Department of Florida, Tallahassee, Fla. It will be of great value to pilots intending to visit Florida this winter.

A NEW CUTTER has just been introduced by the Linde Air Products Company, 30 East 42nd St., New York. It is known as the Oxweld Pipe Cutting and Beveling Machine and consists of a center rod with three spreading arms that press against the inner wall of the pipe, holding it in position. The arm supporting the blow-pipe can be adjusted to any angle of cut.

AT SELFRIDGE FIELD, Mich., construction has begun on several new projects, the most important being two paved landing runways. One runway will be 1,200 x 60 feet while the larger will be 2,170 x 120 feet. There will be an addition to the hospital, a combination fire and guard house, a new bakeshop and a boat-house. A new 8-foot fence will be erected around the reservation.

MARCH FIELD, Calif., will proceed with new construction to the alloted amount of $274,012. Labor from Riverside, Calif., will be hired exclusively, taken from a local reemployment bureau.

END.

Fairchild "22"

(*Continued from page* 109)

ribs are now placed in an upright position in their proper locations and cemented.

Make wing tips as shown on plan from ⅛ inch sheet balsa. This type of wing tip is far superior to that of bamboo, it is simpler to construct and neater in appearance.

The ailerons are now built into the panels. Refer to photo of framework of model. Ailerons will eliminate the need for building "wash-in" in the wing. We recommend that you build your model with all movable controls. After both wing panels have been completed, block up both wing tips, so that you have a dihedral angle of 2° and cement at center.

Cover wing with tissue, making sure all wrinkles have been stretched out of the surface. Cover ailerons separately.

TAIL GROUP

This is made entirely of balsa and is also constructed upon the plan. Cover each part separately with tissue in much the same manner as the wing. Aluminum hinges are cemented into position after framework has been completely covered. All surfaces are either steamed or watered, so that the tissue will be taut. When thoroughly dry, give surfaces a coat of dope.

FINAL ASSEMBLY

Cement all cabane or center-section struts in position, to receive wing panel. Cement wing panel to these struts, making sure you have the proper alignment. The wing struts, etc., are now added. The elevator is cemented directly to the tops of body stringers at rear, with the rudder on top. Use a small piece of balsa as a fillet between fin and former 7.

PROPELLER

For this model we have two types of propellers—flying and scale. The flying propeller is very simple to construct and is very efficient. The scale propeller is used only for display purposes.

END.

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Manufacturers of Progressive Aircraft Finishes

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AMERICA'S OUTSTANDING CHOICE
The WACO Aircraft Company · Troy, Ohio

Airy Chat

(Continued from page 74)

No. 2 is highly flattering—You're a diplomat, D. R.—a real diplomat. Then, arrives an assortment from C. Radwanski, 18075 St. Louis St., Detroit, Mich. Well, there's no use stalling it off any longer, so here we go.

Made loop — Dead engine
Too tight — Washed-out bus
Finished with — Ike bawled—
Hitch-hike. — Poor cus.

So far—so good. But why do all the dinkys deal with crashes? Seems as if we could get on some other theme. Let's try it.

* * *

PARKS Air College, Parks Airport, East St. Louis, Ill., has issued a valuable book on the courses in aviation conducted at their college. This old and reliable school has entered into a detailed outline of the courses, including the Aeronautical Engineering Course, which should be in the hands of every student and intending student of aviation. It's free.

* * *

WELL-WELL-WELL! Miss Lucille Greensley, 7946 Laflin St., Chicago, Ill., writes in to tell us of a new aviation club of girls—the Calumet Kieweittes organized at the Calumet Senior High School, Chicago, Ill., (shouldn't this be "Kiwi-ettes, Lucille?) At present it has over 100 members which places it high among aviation clubs in the point of membership, at least. We are glad to hear of such an organization and am sure it will fulfill its destiny.

* * *

CHOCK-FULL of information on model building is the new "Book of Model Airplanes," published by Comet Model Airplane and Supply Co., Chicago, Ill. It was written by William Bibichkow who is to be complimented upon the scope and excellence of the work. After carefully reading the book, it is difficult to discover anything on the subject of model building that has been omitted in the 88 pages of text and illustrations. And, in the rear of the book are three-view drawings of full size airplanes together with four full size model drawings. The price is 50 cents.

* * *

IF YOU intend flying to or in Florida this winter, then you'd better send for the very complete and comprehensive aviation map of Florida being issued by the State Road Department of Florida, Tallahassee, Fla. This map has been very carefully thought out and full of information to pilots regarding Florida airports and codes. When unfolded, it becomes a strip-map 11 x 34 inches that can be conveniently handled in the cockpit. It's free.

* * *

EUGENE L. VIDAL, U. S. Director of Aeronautics, recently addressed a letter to 34,000 airmen in the United States, asking them if they would be interested in purchasing an airplane if the price were approximately $700.

The total returns to this survey up to the time of the last report, was 7,661. Of this number, 5,642 were affirmative replies and 2,993 were "yes" without comment or qualification. The 2,019 who stated that they were not interested explained, in the most part, that they could not afford a plane or were professional pilots who did not wish to engage in additional flying.

What we are interested in, principally, is some means by which present privately owned planes can be put into the air—existing planes—and so set an example for the others. And the only way to accomplish this result is to kill the meddlesome supervision of aviation by governmental or state officials.

* * *

IT IS interesting to recall many of the famous pilots who have written their names in aviation history, and speculate upon the probability or improbability of these air heroes getting a private license under the present laws. In most cases, they would be ruled out by the physical disability regulations. Georges Guynemer, ace-of-aces in the World War, tubercular and with goiter, most certainly could not pass the physical examination.

* * *

So long.—J. B. R.

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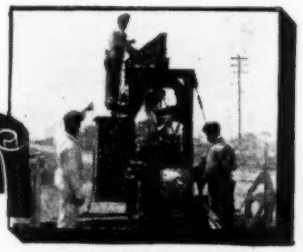

Ready For Test Block After Overhaul

Gyroscope

(*Continued from page* 102)

second. The value thus obtained would be the moment of inertia I from which the radius of gyration could be calculated as $K=\sqrt{I/W}$.

This method however, is somewhat cumbersome, since the propeller blade could not very well be perforated for insertion of the axis of oscillation, and would therefore demand special mountings and clamps, as well as the use of a split-second stop watch.

On making exact calculations however, it will be seen that the radius of gyration of the average propeller blade works out to about K=.3R, when R is the radius of the propeller. This value of course will vary in different makes of propellers and in some cases may be found too high. It is, however, sufficiently accurate for the present purpose and will accordingly be substituted in formula (1) Hence, since K=.3R ft., $K^2=.09R^2$.

The second quantity to determine is the *precessional velocity* v, that is, the linear velocity of the center of the propeller about the center of gravity of the machine.

Referring to the diagram shown in Fig. 7:

Let r=the radius of the turn in feet.

V=the speed of the plane in miles per hour=1.466 ft. per sec.

l=the arc of the circle with radius r traversed in one second.

The length of the arc l then is 1.466 V feet and the angle $d=\frac{1.466V \times 360}{2\ \Pi\ r}=\frac{1.466V \times 360}{6.282}=84.038\ \frac{V}{r}$ degrees.....(2)

After one second from beginning the turn, the plane has rotated about its center of gravity to the extent of the angle d.

In Fig. 8 the plane is shown in the position it has attained at the end of one second from the beginning of the turn. A denotes the center of gravity of the machine corresponding to the point A in Figure 2. C1 is the center of the propeller in its new position, and C represents the position of the center of the propeller with reference to the center of gravity of the plane if the machine were still heading in its original direction. The distance AC=AC1 is the leverarm of the gyroscopic force P corresponding to C in Figures 1 and 2.

On making exact computations it will be seen that the difference between the length of the arc CC, and the straight line ACC1, representing the chord, is very small so that for the present purpose ACC1, may be regarded as an equilateral triangle in which AC=AC-=C and the angle A equals x. Bisecting the angle X by the normal AD from A to CC1 we have

$$\text{Sine } X/2=CD/C \text{ or } CD=C \text{ sine } \frac{X}{2}$$

$$\text{and } CC1=2C \text{ sine } \frac{X}{2} \quad \text{.....(3)}$$

Now since CC1 has been taken as the distance traversed by the center of gravity of the propeller with reference to the center of gravity of the plane we get

$$\text{Precessional velocity } V=2C \text{ sine } \frac{X}{2}$$

feet per second.

In formula (1) the last factor is V/C which can therefore be written as $\frac{2C \text{ sine } X/2}{C}=2 \text{ sine } X/2$ .....(4)

By substituting the above values and inserting the values for II and g, formula (1) becomes

$$PC=\frac{W}{32.17} \times .09R^2 \times \frac{3.14N}{30} \times 2 \text{ sine } X/2$$

$$PC=WR^2N \text{ (sine } X/2) \times \frac{.9 \times 3.14 \times 2}{32.17 \times 30}$$

$$PC=.000586\ WR^2N \text{ sine } X/2 \quad \text{.....(5)}$$

$$P=.000586\ \frac{WR^2N}{C} \text{ sine } X/2 \quad \text{.....(6)}$$

in which $\frac{X}{2}=42.019\ \frac{V}{2}$ degrees.

By means of formula 5 and 6 the gyroscopic force and the gyroscopic moment can thus easily be calculated with a fair degree of accuracy which applies for all practical purposes. In high speed planes the gyroscopic force can be worked out with 100 per cent precision by calculating the precessional velocity according to the arc CC, instead of the chord.

If a 100 per cent accuracy is required it would of course be necessary to determine the radius of gyration of the propeller by any of the above suggested methods. CC by calculation, graphically, or experimentally.

Let C=5 ft. (Distance of center of gravity of propeller to center of gravity of plane).

W=40 lbs. (Weight of propeller).

2R=7 ft. (Diameter of propeller).

N=2200 R.P.M. (Revolution per minute of propeller).

Speed of the plane is V=140 M.P.H.

What will be the gyroscopic moment and the gyroscopic force created by the propeller in a turn of 200 feet radius, assuming that the flight path and the center of the turn remain in the same horizontal plane, and without reference to the dynamic factor created by centrifugal force?

$$X/2=42.019\ \frac{V}{2} \text{ degrees} \ldots X/2=42.019\ \frac{140}{200}=29.4°$$

Sine 29.4°=.4909.

$R^2=3.5^2=12.25$.

PC=.000586 x 40 x 12.25 x 2200 x .4909 =310 ft. lbs. *acting down.*

Since C=5 ft. the gyroscopic force is P=310/5=62 lbs. *acting down.*

It is seen that a counter moment of 310 ft. lbs. must be produced by the tail surfaces in order to keep the machine in a horizontal flight path.

Considering the downward acting force P as a weight and assuming the normal weight of the machine to be 2000 pounds it will be found that the center of gravity is thereby shifted 14.2 inches forward, which is enough to cause disaster unless skillfully counteracted by the pilot. The plane, when swinging around the turn is subjected to centrifugal force whereby the weight supported by the wings may be manifoldly increased, and the plane will also assume a naturally banked position which increases as the radius of the turn is decreased.

END.

B/J XF, Span 14" FOKKER TRI. DRI., Span 12½" BRITISH S. E. 5, Span 13¼" Curtiss Swift XP-934, Span 13½"

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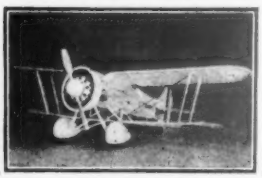

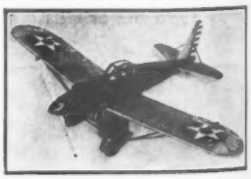

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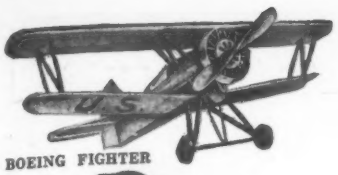
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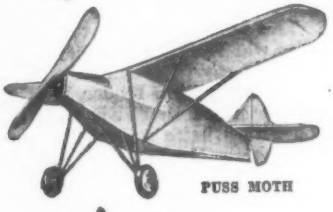
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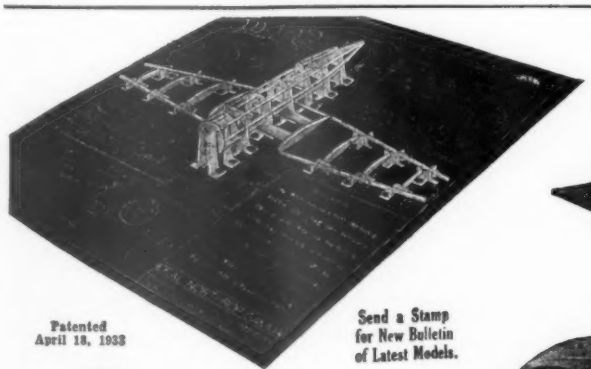
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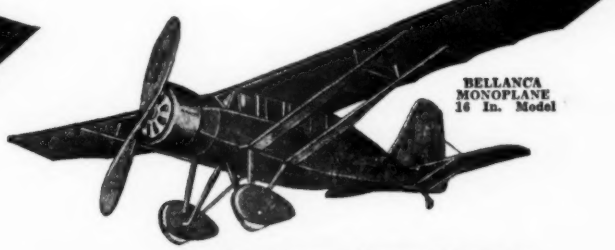
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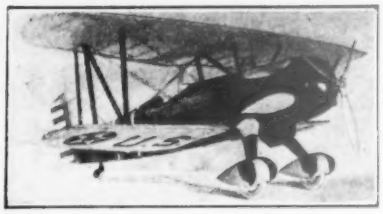

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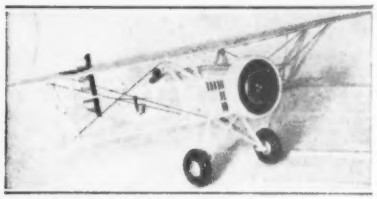

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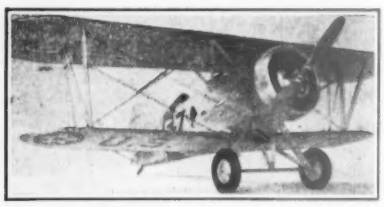

22½" Span, Weight 2¼" oz., Flies 750 Feet

Set contains 3" celluloid motor, aluminum drag ring and motor plate, ribs and formers printed on balsa, celluloid wheels, silver discs wing, rudder, Army and fuselage insignia, semi-finished prop., Yellow and silver dope, glue, drawing and all materials. Const. Set, P.P.....$ 2.95

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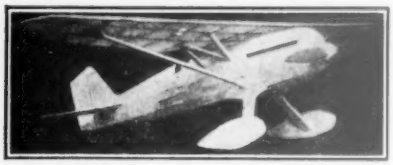

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Q & A

(*Continued from page* 102)

QUESTION:—John J. Baird, Portland, Me. *What percentage of the total resistance of an airplane is the resistance of the landing gear? Does the landing gear contribute much to the resistance and the loss of speed?*

Answer:—TESTS have shown that the resistance of the landing gear will range from 20 to 40 per cent of the total resistance of the complete ship. This is one reason why retractable landing gear is now so popular on transport ships. On the other hand, the weight of the retractable gear is usually more than that of the standard type gear which is equivalent to partly offsetting the gain shown by the reduction of resistance.

* * *

QUESTION:—George H. Hutchins, Mendota, Ill. *Has the State of Minnesota passed a law against homemade planes?*

Answer:—YES, and it has been enforced on a number of occasions.

* * *

QUESTION:—Alfred Rawlings, Tulsa, Okla. *What effect has the compression in a gasoline engine cylinder? I know that compression increases the power and efficiency of the engine, but why?*

Answer:—IN the first place, the heat produced by the compression of the charge, assists the vaporization of any gasoline that may be in the liquid state, thus increasing the amount of heat liberated by the fuel. Second, since the mixture is crowded into a much smaller space, there is less loss of heat by radiation since the flame spreads more rapidly through the compact volume and there is less of the gas in contact with the cold cylinder walls. The theoretical reasons differ from the above, but it is likely that the reasons quoted are the more important.

END.

20" BOEING P-12-E

Photograph of the Boeing P-12-E Model

ITS HERE: A Super Detailed True Scale Ornamental Model of the famous BOEING P-12-E. You will be amazed at the striking beauty and detail of this distinctive model. Note the corrugated control surfaces, wing walks, naturalistic engine cowlings, even the ignition wires.
This model is available in carefully constructed Finished Form. And in form of an unusually large and most complete Construction Kit, easy to build up. The kit contains all the necessary material, plenty of dope, cement, lacquer, balsa wood, bamboo, wheels, etc. Also lots of miscellaneous material that goes to make up the detail. Together with a full size Three View Drawing, Pattern Layout and Instructions. The price of this large kit is only $4.75 complete. Postage 30c extra. Send 10c for photo and price of finished models. Descriptive folders 5c.

VICTOR STANZEL
High Grade Model Aircraft
SCHULENBURG, TEXAS

Propellers

(*Continued from page* 113)

After cutting to this size and shape, the remainder of the work which lies before you is very easily accomplished. It is necessary that you follow all dimensions very closely in order to obtain the maximum efficiency from your propeller. As you will note in dimension D, pitches are figured out to be equal, so as to give a more even pull.

CARVING THE PROPELLER

(A) In procuring the wood for your propeller blade, make sure same is of a close texture, having a very straight grain. This is necessary in order that the blades will be firm after they have been properly carved to shape.

(B) With a pencil and ruler, lay out blank as described in STEP II. Cut to shape with a knife or small saw in order that your blank when complete will have all sharp edges. It is very important that this step be carefully worked out as the pitch of your propeller is now at its maximum pitch angle. Next, draw a diagonal line at either end of the propeller blank, so that if it were possible to see through blank, it would form an X. With a straight pin or drill, make a hole through center of hub for propeller shaft.

(C) As viewed from the rear of the propeller the surface appears to be concave, in other words, cup-shaped. Working toward the tips from the center, carefully cut blank down to outer edges and diagonal line at extreme end of propeller blank, allowing enough stock at tip to strengthen dip. Carve opposite end in like manner.

(D) Cut away excess wood on front face of propeller, so as it will be convex, in other words making it appear oval in shape.

Tips of propeller are made circular by tapering edges down as shown in diagram. In carving, always bear in mind, the hub of the propeller is quite thick, while the blades taper off, becoming thinner at the tips. With a piece of sandpaper partially smooth up the surfaces so that a balance test may be taken. Slip a small shaft through center of hub in order that propeller may revolve freely. If properly balanced propeller will remain at any position in which it is placed. A four point test should prove most satisfactory. If not properly balanced carve or sand away wood on heavy blade.

To give your propeller a finished look as well as strength, we recommend several coats of banana liquid with a light sanding between each coat.

Vibration of a propeller may be due to several causes besides simple unbalance. It may be caused by a bent shaft or by reason of the prop not being truly at right angles with the shaft. And, if the final shaft is not as large as the test shaft, there may be sufficient slack to cause vibration.

END.

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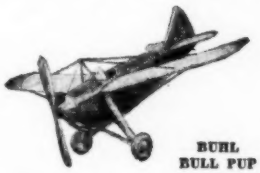

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½" size	$ .50
½"	.60
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½"	5c ea.	¾"	6c pr.
⅝"	6c ea.	1"	8c pr.
¾"	7c ea.	1⅛"	10c pr.
⅞"	8c ea.	1⅜"	16c pr.
1"	9c ea.	1⅝"	40c pr.

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Dia.	Drag Ring	Open Face	Closed Face
1"	10	13	13
1½"	15	15	15
2"	20	20	20
3"	28	28	28

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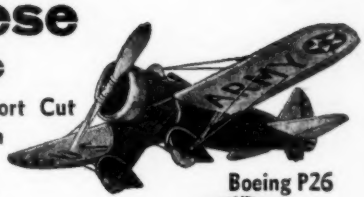

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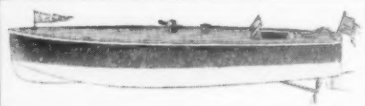

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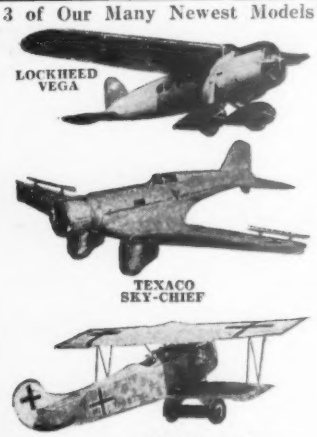

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Bombing

(*Continued from page 80*)

that most of the journey home was made on one engine.

The last year of the conflict saw bombing in full swing. It was a year of reciprocal bombardment. Constant urgent calls from the military for long distance raids resulted in the British organizing the Independant Air Force, which was composed entirely of bomber squadrons.

The French organized the Air Division, which consisted of two pursuit brigades of twenty-four squadrons, and two bombardment brigades of fifteen squadrons, with three protection squadrons of big three-seater airplanes. These latter, however, were too slow and cumbersome to ward off the attacks made by the fast German pursuit craft, and generally bore the brunt of the battle.

In one such case, three of these ships, which were the only pursuit protection with the bombers, were the first to go down under the onslaught. But as the raids were carried further inside the lines, it was impossible for the smaller pursuit ships, with their short cruising radius, to accompany the bombers the entire distance. Arrangements were therefore generally made for this protection to meet the bombers on the return home.

When it was possible to locate them on the return, the bombers more often had company in the shape of fifty to sixty Albatros and Fokker scouts. It would be a fortunate day indeed, if one-third of them managed to get that far back, and generally all of the crews of these would be wounded and their airplanes riddled with bullets.

Personnel of the bombardment units suffered heavier losses than the pursuit division. The casualties of our own First Day Bombardment Group were twice that of the First Pursuit Group, which incidentally bore the brunt of our air fighting, inasmuch as it was the first of our combat units on the front. This was true in all of the air services, with the possible exception of the German air force, whose losses in pursuit were undoubtedly higher than that of their bombardment.

The achievements of the American First Day Bombing Group on the front are interesting. The group, as a whole, was not completed until October, 1918. In June, the 96th Squadron started operations and up to the time of the Armistice had dropped 649 tons of bombs. The 20th Squadron and the 11th joined the 96th in September, when the Group started to function.

They dropped respectively, 279 tons and 223 tons.

The 166th Squadron joined up in October, and kicked their tail gates for a 113 tons of bombs in the short time that they were on the front. These squadrons, operating as a group, accounted for forty-six confirmed victories over enemy aircraft. Their most important targets during their last days on the front were at Montmedy, Longuyon, Dommary-Baroncourt, Conflans and Corny.

The Second Day Bombing Group, consisting of the 100th, the 163rd Day Bombing Squadrons and the 115th Night Bombing Squadron, had just been organized and was stationed on the Ourches airdrome when hostilities ceased. As a result it did not get to see any action.

During the last year and a half, single-seaters were utilized for low bombing against ground troops, as attack aviation at that time was unknown. The Germans, though, used a special type of two-seater for this purpose. A campaign against airdromes was instigated by the Allies, with a view of destroying German pursuit planes so that the bombers could work unhindered, and an effort was also made to neutralize German bombardment by destroying the bombers on the ground.

Night pursuit squadrons were organized to combat the menace in the dark. We had the 185th Night Pursuit Squadron, consisting of Sopwith Camels and attached to the First Pursuit Group. One of the most successful of the night squadrons was the 151st Squadron of the Royal Air Force. This Camel outfit accounted for twenty-one of the large German bombers in two weeks of night sorties.

This need for night pursuit grew out of the policy of the German air force to do most or all of their bombing at night. As a consequence, very little bombing was done by them during daylight hours and every effort was put to meet this new situation. The 187th squadron came into being during the Argonne-Meuse offensive. It had little time to operate and was handicapped by a shortage of pilots and airplanes, but succeeded on several occasions in making contact with the enemy.

The Germans were fully aware of the part to be played by night bombardment. Many factories were turned over to the air service to build these monsters, as the existing airplane factories were being taxed to their utmost. Squadrons on the front had to have replacements, and new units were continually going into the field. Bombers had to be obtained, and quickly.

The Essen Works was one of the first of the factories to be taken over. They were awarded a contract for three hundred machines of the giant R-type, fitted with six engines. Four of these engines were in two sets in the center, so they actually drove four propellers. These were armed with five machine guns.

Then, the Link-Hoffman Railway Carriage Works at Breslau was commandered to turn out the Giant Riesen four-engined bombers. The Albatros Works soon had their Giant R-1. This was another eight-seater with six Mercedes 260 horsepower engines which drove four propellers. The two center plants were pushers, while the wing

engines were tractors. This machine was a flying arsenal carrying six machine guns and two tons of bombs.

The Gotha firm then came out with their G-VII, G-VIII and G-IX, Friedrichshafen turned out the new G-IVa, A. E. G. came out with the G-IV, a new three-seater with a remarkable performance. Siemens-Schuckert R-8 bombers with three engines were beginning to be seen over the lines. The Zeppelin Five Engined Giant, with a useful load of 9,000 pounds, had already raided England and others of the same type had been attacked and shot down.

And to top it off, the Lizenz, nine-seater bomber, with a span of 140 feet, was riding the night skies with four Maybach 300 horsepower engines. Not content with that the Lizenz engineers had just completed plans for the same ship with six Maybach 500 horsepower engines. Had the war lasted longer it too would have become a reality, but it was too late now. Allied ships had broken up the famed Jagdstaffels and driven them from the air, so it remained for the Allied bomber crews to do the rest.

Just preceding the St. Mihiel offensive, the greatest concentration of aircraft was assembled, that was ever placed under one command. Although the American squadrons were being equipped as rapidly as airplanes and pilots became available, our air force at that time consisted of only seven observation squadrons, one day bombing squadron and twelve pursuit squadrons. Two other pursuit squadrons were serving with the British and were therefore not available.

The French, thereupon, placed at our disposal a large number of their squadrons, while a number of bombing squadrons of the British Independant Air Force also joined up. Shortly afterwards, and just before the drive commenced, some of our new units became available and these were hastily rehearsed in their part of the plan.

When the concentration was complete, this force consisted of 1,482 airplanes. They were all placed under the command of the Commander of the First Army Air Service, and consisted of 701 pursuit airplanes, 366 observation planes, 391 day bombardment and 91 night bombardment airplanes. At no time had there ever been so large a force of aircraft assembled on any front.

The moving of this force into advanced airdromes was accomplished with the utmost secrecy, as any marked concentration would immediately have aroused suspicions of the Germans. However, all units were in place several days ahead of the attack, which commenced on September 12th. Although it took only four days to complete the wiping out of the St. Mihiel sector, the air forces were compelled to operate the first three days in very unfavorable weather which caused all flying to be done under one thousand meters.

On the third day, many new enemy pursuit organizations were identified, and it became evident that they had been heavily reinforced. The day bombardment squadrons composed of American, French and British airplanes, which were penetrating well back into the rear areas, now began to suffer severe losses. The high winds and low clouds prevented any semblance of formation being flown, and the Germans were tenaciously attacking at every opportunity, endeavoring at the same time to cover their retreat.

The attack on the St. Mihiel salient added new laurels for the bombers. Much material damage had been done, and confusion in the rear of the enemy lines successfully prevented them from bringing up the much needed reserves and supplies. The most outstanding features of the employment of this large air force were the continous attacks made by brigades of nearly five hundred airplanes each. While one brigade was over the objective another would be taking off, while the third would just be returning and refueling. By this means a distant objective was subjected to an attack as continous as if done by heavy artillery.

The raids of the Independent Air Force and the French Air Division struck terror everywhere. In the attack on Fere-en-Tardenois, nearly 150 ships were in the air. The German supply depot in the woods was completely destroyed. Twelve of our large bombers went down in flames, their crews perishing with them, while six of the escorting pursuit were shot down. The Germans lost twenty scouts in attempting to ward off this attack. Other towns came in for their share of these attacks in the Ruhr district. Mannheim, Saarbrucken, Cologne, Frankfurt, Kaiserslautren, Karlsruhe and Treves soon learned to distinguish a bomber from a pursuit ship, 709 raids were made by the Independent Air Force. One hundred and eleven bombers were lost, while they destroyed 150 German scouts in the course of their combats, which is a good score considering that the bombers did not go out of their way to seek combat. That was one thing they could be sure of, trouble always came to them.

The long hoped for four-engined Handley-Pages did not reach the front until November. With their arrival it was expected to push the war still further back. Plans had been already made to bomb Berlin with them. This type had also been adopted by our own forces and two squadrons of them were composed of Americans. The fear of gas bombs being employed, as the bombers soared nearer and nearer in those last months, caused panic to reign in the capital of Germany. The Kaiser skipped to Holland and safety, and the citizenery decided it was no use for them to be the dead heroes, so they called it quits, while the bomber crews, who fought the greatest odds and suffered the heaviest casualties, went home without becoming aces.

END.

Balloon

(*Continued from page* 114)

this line, all the way down to H and mark these points O, A, B, C, etc. All of this layout work must be done very accurately to insure perfectly fitting gores and a round smooth balloon.

Starting at A, mark off distances equal to J'K', JK, LM, NP, etc., in such a way that the straight line passes right through the middle of these distances. Run a line through these points and you will have the exact shape of one of these lunes or gores. This lune of wrapping paper is now cut out and is used as a pattern for cutting the tissue. The job will be more accurate if the tissue is piled so that several sheets are cut at one time. Don't forget at this point that a selvage of about ¾ inch must be left all around the pattern to allow pasting surface.

The seams can be fastened with banana oil or rubber cement. If the latter, be sure to apply the rubber cement on both surfaces or it will be certain to come apart. Don't use paste containing water as a water paste will cause wrinkling and bulging.

And now for the heater that is to supply the warm air. Get some very thin asbestos paper at the hardware store or plumbing shop and roll it up to form a tube about one inch in diameter and four inches long. Seal at one end with asbestos paper and the tube is then attached to the paper cone that fits in the bottom of the bag. Three supports, made from music wire, support the tube in a vertical position.

The wire is attached by weaving it in and out like a pin in cloth, while the loop in the wire is for radiating heat before it reaches the glue where the wire is attached to the cone. The ends of these wires are then bent to a hook shape where they are extended to the top of the cone, and they must be made so that they will slip over a rattan ring which fits around the bottom of the bag. In short, the heater in the cone must be made so that it can be quickly detached. The cone slightly overlaps the opening in the bottom of the envelope.

The gondola has a diameter of about 1/14 the diameter of the envelope.

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Aerial Police

(*Continued from page* 84)

ON every flying day the air police force, of fourteen men and four planes, patrols the air above New York. During the busiest hours there are three complete air patrols, each taking one hour. They look especially for pilots flying below the required minimum altitude of 1000 feet, stunting, or otherwise endangering life. In 1932, the police planes from the municipal airport at Floyd Bennett Field, Brooklyn, patrolled 43,731 miles and flew 583 hours, 5 minutes. In the same period the air police investigated 56 complaints, resulting in 12 prosecutions and 28 reprimands.

Their work seems almost to have ended the risk of aircraft accidents to the citizens on the ground. There were nine such accidents in 1929, when the air police were organized on a working basis; seven were killed and 21 injured. In the following year such crashes were reduced to three, with six killed; in 1931 to two, with three killed and one injured. In 1932 there were five crashes, with six killed—but all at airports, none over the rest of the city.

This record is especially creditable when it is considered that 21 per cent of the planes and 29 per cent of the pilots in the United States are licensed from the area centered in New York, and that there has been a considerable increase in flying.

Such results seemed unlikely when the air force was established, following a preliminary period when the idea was regarded as a publicity stunt. But, practically organized, it had a firm basis. The pilots chosen were experienced men, some of them with war experience. Behind them, in advisory capacity, were such well-known authorities as Col. Clarence D. Chamberlin, Rear Adm. Richard E. Byrd, Col. John H. Howard, Lieut. Comdr. R. F. Whitehead, William P. McCracken, Jr., Maj. Edward V. Picken, Maj. John Dwight Sullivan, and Rodman Wanamaker.

The air cops—as they came to be familiarly known—were not taken very seriously, at first, by many in the police department on the ground. This attitude began to change when the first case of the air police, before Special Sessions in Queens County, resulted in a fine of $100 and a general warning to pilots flying over New York that air traffic regulations meant what they said.

The pilots of an advertising blimp that often cruises over the New York area, consult Acting Captain Arthur W. Wallender before taking off, as do many airplane pilots. They owe the air cops for the institution, on December 12, 1930, of local flying-weather reports broadcast daily from WNYC, New York's municipal radio station.

The air police have developed a system of radiophone communication between plane and ground, useful in mob and traffic work and in many other ways. A good test was the famous beer parade which drew a crowd so large that ground police found it difficult to handle. Because of its ability to hover, a Goodyear blimp was pressed into service. It was equipped with a two-way short-wave radiophone with ground contact via a special station at the old Arsenal on the Fifth Avenue side of Central Park.

Captain Wallender, Colonel Chamberlin and others in the blimp, spotted congested localities from their bird's-eye view and phoned directions to the ground station, from which motorcycle couriers were dispatched by Inspector Bolan with orders which straightened out kinks and confusion in traffic.

At an unemployment demonstration, fomented by Communists, serious trouble threatened. Inflamed by violent speeches, a large section of a great crowd in Union Square began milling around. Many ground police were on duty, but the crowd was so dense that handling it became increasingly difficult. Momentarily its temper became uglier.

Then, the close air over the Square was stirred by the sweep of wings and the drumming of powerful motors. The crowd looked up. Flying in perfect formation were four airplanes, each marked in large letters POLICE. Silhouetted against the sky, they came on, and downward. Part of each silhouette was a sinister slender shape.

"Machine guns! They've got machine guns!"

The armed planes swept still lower, until they seemed to be rushing down into the faces of the milling crowd. The sound of the motors became a snarling roar, a warning. The crowd began to break.

"They're going to drop bombs!" someone cried.

The riot was over—almost before it had begun. With a final bellowing roar the winged cops were off again.

No machine guns were fired, no bombs dropped; the threat was enough . . . The same kind of threat was effective again when used against an out break of prisoners at Welfare Island. It greatly helped the ground cops to break up a dangerous situation, and they were grateful. A number of lives unquestionably were saved.

* * *

THE J-3 rescue work was off the regular beat of the air police. Much of their work is done in co-operation with the marine division, helping to police New York's harbors.

At 11 o'clock on the morning of May 9, 1930, Pilots Thomas Mason and Francis Dieffenbach took off from North Beach for a patrol over Long Island Sound. Looking down upon the pleasant sight of a graceful private yacht at anchor, they saw a speedboat leave her side and make for shore. Suddenly the speedboat capsized.

Mason, at the controls, dived the police plane. It alighted near the drowning man and quickly taxied to where he was making his final struggle. They pulled him aboard, gave him hurried first-aid, and took him ashore.

Two Yale students, William W. Barksdale, Jr., of Clarksville, Tenn., and Henry C. Rowland, Jr., of Washington, came to New York for a week-end, late in October of 1932.

"The only real way to see the town," proclaimed Barksdale, "is from an air plane."

"Yeah?" retorted Rowland. "And how?"

So they went to Floyd Bennett Field. A two-passenger plane took Barksdale's eye.

"I can fly that," he said. "I'm a licensed pilot."

The owner took his word for it. Soon, with Barksdale at the controls, the plane was headed toward the tips of the tall buildings. But it never reached them. The motor stalled when they were over the Upper Bay—three thousand feet over.

They splashed into the cold water off Sixty-ninth Street, Brooklyn. The plane nosed over and dumped the joy-riders in for the coldest shower of their young careers.

A few seconds later there was a more skillful splash nearby. Pilots Frank Harkins and Quelle Freedman in a police plane had seen the plunge and followed the boys down. Harkins leaned out from a wing to pull them to safety. Not an easy job, against a strong tide and sea and a 22-mile gusty wind. Just as he had managed it, and all three were on the slippery water-drenched wing, they were almost thrown off. Their weight was capsizing the amphibian when Freeman ran out onto the other wing to counterbalance it. Then the air cops and the Yale students flew to safety. The sightseers were willing to call it a day.

END.

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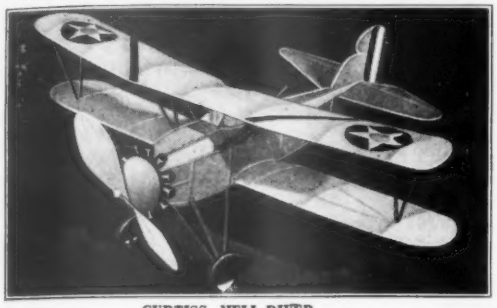

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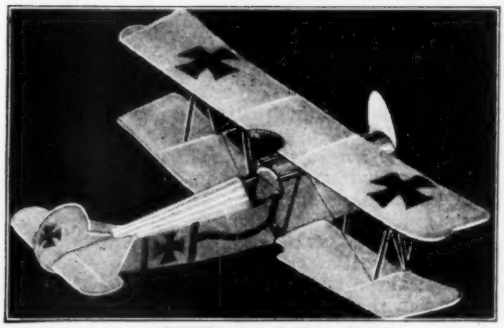

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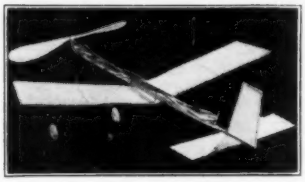

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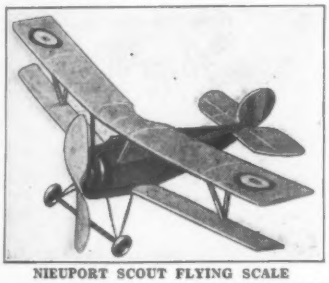

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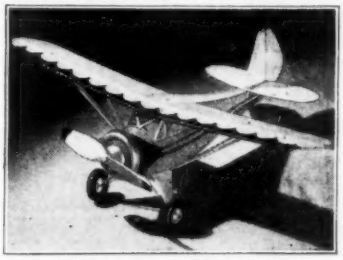

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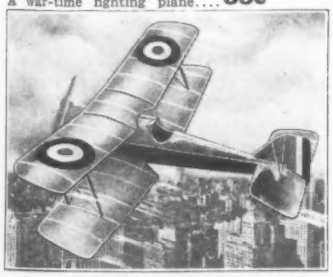

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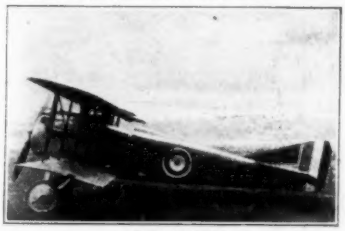

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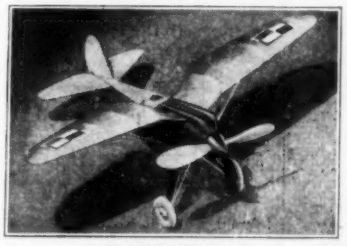

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Hammondsport

(*Continued from page 78*)

dour and pre-occupied of countenance, going about quietly, with his keen gray eyes unobstrusively taking the measure of a crew of pupils who could do much to make or mar the reputation of the Curtiss School by either following or disregarding his instructions. Somewhat evasive of point-blank questions, and rather averse to committing himself on any point, he knew in his own mind that what was deemed satisfactory today, would be improved upon and work better tomorrow. Was there ever an inventor who could leave well enough alone? "So why make a statement now that might be called in question a short week hence?"

Glenn Hammond Curtiss was born at Hammondsport in 1878. Ever interested in things mechanical, he contrived by dint of much experimenting and improving, to build a first-rate little motorcycle with which he leaped into prominence in 1906 by winning the motorcycle record for speed at Ormond Beach, Fla. He made a mile in 26 2/5 seconds, which resulted in the erection of a motorcycle factory which throve and expanded as the demand for his product increased. Then followed the association with Dr. Alexander Graham Bell of telephone fame, who in those days was concentrating his attention on man-carrying kites which took the shape of the many celled gliders familiar to all students of the subject. In 1907 came into being the Aerial Experiment Association of which Glenn Curtiss was a director.

Having ideas of his own on the subject, he experimented with biplane gliders, in the meantime working out a satisfactorily functioning neat little aeroplane engine, and in 1908 the famous "June bug" was evolved, the first of a series of Curtiss aeroplanes, the end of which is not yet in sight. The June Bug won him the Scientific American cup. The June Bug design, by effecting various improvements, was transformed into the well-known Curtiss Pusher biplane equipped with a 35 H.P. four-cylinder Curtiss Motor and with this machine he won the cup at the Rheims International Meet in 1909.

The efficacy of the Curtiss Biplane was now generally recognized and the reputation of the machine and its originator was further cemented by the famous Albany to New York flight in 1910, by which Curtiss won the $10,000 New York World prize, the distance of 143 miles being covered at an average speed of 49.5 miles per hour.

The Curtiss Aeroplane Company was now fairly launched and the aeroplane factory back on the hill among the vineyards had to be enlarged to fill the orders that were fast coming in. Many young men were attracted by the opportunities offered by the Curtiss Exhibition Co., a flying school was established at Hammondsport as well as on North Island, San Diego, Calif., and in both places, many famous flyers were being developed, not the least of whom was Lincoln Beachey, soon to be world-renowned.

Engine development went on apace, a sixty H.P. engine was soon produced, to make room in its turn for the 90 H.P. Curtiss O. and its immediate descendants the Curtiss OX series, which were extensively used during the war on the Curtiss' J. N. training machines and others. With the advent of this comparatively speaking, high powered engine the development of the hydro-airplane was greatly accelerated since a hydroplane needs more power to take off than does a land machine.

The experiments leading to the invention of the Curtiss Standard Hydro-airplane were extremely interesting. The idea probably germinated during the Albany-New York flight over the broad Hudson River, on which memorable trip Curtiss carried a light canvas boat strapped to the bottom skid of the plane. As he stated afterward "The river looked extremely deep."

This precautionary arrangement evidently suggested the idea of a float of some kind which was to form an integral part of the machine and would take the place of the landing gear. A short time afterwards, experiments along those lines were commenced at Hammondsport, the first floats used being a pair of canoes which however proved to be unsatisfactory. When tipping the plane up in order to take off, the rear part of the canoe would be forced down and fill up with water which had to be bailed out to prevent them from being swamped, so the next step was the addition of an oilcloth cover.

Another trouble then developed, namely the suctional action on the rounded bottoms of the boats, whereby the machine was prevented from leaving the water. The canoes were accordingly discarded and a flat-bottom box-like pontoon was substituted.

Modifications were essayed, such as placing the engine in the hull and driving two propellers by means of a chain transmission; in another experimental construction the pontoon was provided with wheels.

This arrangement is especially noteworthy inasmuch as it constituted the Curtiss hydro, the first amphibian plane ever built. These experiments, however, were only of a preliminary nature and intended as a basis for future development and research. The Curtiss hydro-airplane was a great success and the machine became immensely popular. For school purposes it certainly had no equal, and in spite of its seemingly light construction it was able to withstand an immense amount of buffetting. During the summer seasons the school hydro would make as many as 40 trips a day, each trip covering about 10 miles and consisting mostly of landings and take-offs which Curtiss deemed the most essential part of the training.

It was evident, however, that Curtiss was not satisfied with the hydro which in rough weather provided but scant protection, if any at all, from spray and waves, so the next logical development was the Flying Boat, which is one of the outstanding achievements in Aviation. The first Flying Boat was

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built and flown in 1911 on Lake Keuka. It comprised, a set of wings carried by a hull with a continuous bottom which took the place of the hydro-pontoon, the controls and the occupants being contained within the hull, while the tail surfaces were carried by the after part of the hull. This design needs no further description since everybody is familiar with it; it has persisted since the day of its inception and differed only in matters of detail from the flying boats now in use.

Since some difficulty was experienced in getting off the water, the next and most notable improvement in order was the introduction of the break in the bottom, the "step" as it is termed, whereby the detrimental suctional action of the rear part of the hull was eliminated, the suction being still further diminished by apertures in the bottom back of the step which communicated with the air on the top of the hull. The machine was thereby able to rock on the step prior to taking off without suctional interference of the after part of the hull.

Thus in the short space of one year, the flying boat was invented and practically perfected. The flying boat as it is used today is in all essential features a replica of the boats built by Glenn H. Curtiss in 1912. A further innovation was introduced in 1913 when the pusher type flying boat was converted into a tractor type, which necessitated the removal of the front cowl and the shifting of the cockpit to a position aft underneath the motor, thus foreshadowing the still remote advent of the Dornier boat.

Other experimental work was being carried on at the same time. The land machines were coming in for a thorough overhauling; the first experimental tractor was constructed and flown, which was followed by the now well-known type of tractor hydro-airplane. A monoplane flying boat was also constructed which turned out very successfully. New wing curves were evolved and tested in actual flight, new fabrics were employed and tested, and a series of interesting experiments were made with different kinds of wing dopes which were fast replacing the rubber coatings used on the older machines.

Engineering was awarded its share of attention and methods of stress analysis were devised which succeeded the original rule of thumb ways supplemented by experience and horse sense. In spite of those archaic methods, no structural failures of any kind ever occurred on any of the Curtiss machines, the construction in accordance with Curtiss' doctrine of caution, initially rather tending to over-strength than otherwise, and being then gradually reduced to conform with the requirements of lightness.

EDITOR'S NOTE. *This is the first article by "Stonewall Jackson" treating of early days at Hammondsport, N. Y. A second article will follow in an early issue which will be even more instructive.*

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INTERNATIONAL AIRPLANE, 150 H.P., licensed—will trade for seat parachute and $200. —Otto Tomes, 5101 S. Keating Ave., Chicago, Illinois.

WILL TRADE brand new 16 ft. Doane's hydro-bout speed boat OX-5 powered, for a good 2-place open or closed airplane not over 90 H.P. or will consider OX-5 Curtiss Robin. Preferred Great Lakes or Monocoupe.—Russel Ider, 302 Murray Ave., Minerva, Ohio.

LIGHTPLANE WANTED—Licensed two-place ship with dependable motor, all A-1. Will swap Rajo dirt track racer with trailer. All in fine shape. Send 10c for picture and particulars.—Lindsay Bros., Holyoke, Colo.

HEATH AIRPLANE, less wheels, tires and motor. Flown 105 hours. Torn down to recover. 2 cylinder Lawrance motor, complete with propeller, Hickman conversion and new magneto. Flown 35 hours. Will sell or trade. What have you?—Knox, State St., Conneaut, Ohio.

WANTED light airplane, preferably two-place, but will consider three-place. Will take ship without motor. Have two model T Fords to trade plus cash.—E. Wick, Princeton, Wis., R. I.

A.T.C. PARACHUTES to trade for lightplane, late car, or what have you—Eddie Butler, Parachute Service, Dept. Wash. Airport, South Wash., Va.

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WILL EXCHANGE licensed Air King OX-5 Biplane for light ship—mono-prep preferred. Ship has 75 hours since complete over-hauling and new motor. Always hangared; not a dime has to be spent on it.—Homer Agar, Langdon, North Dakota.

WILL TRADE 3 passenger licenseable airplane, speed 105 m.p.h. for boat sail or motor or auto. —Remsen, 769 Hunterdon St., Newark, N. J.

1930 HUDSON Super Eight Sedan, good paint, tires and upholstery, smooth running motor, will trade for licensed two or three-place plane. —Willard Waite, Route 1. Camanche, Iowa.

A 1-PLACE ALCO Cabin fuselage, covered, and complete with tail assembly, landing gear, Anzani 60, and prop. All in good shape. What have you.—Charles Arneson, Devils Lake, N. D.

WILL TRADE 1930 Willys Coupe for Corben Junior or Buhl Pup Airplane.—J. M. Verbos, Hdqtrs. Sqdn. Chanute Field, Rantoul, Illinois.

1932 PLYMOUTH CONV. COUPE, very good condition. Will swap for light plane—preferably Aeronca—What have you?—George Jensen, 1717 Blair St., St. Paul, Minn.

WANTED—Lightplane fuselage complete with tail surfaces and landing gear, and motor. Have a Johnson Seahorse 32 with hi-compression pistons and heads and racing prop.—S. Jewett, Gale Avenue, Laconia, N. H.

WANTED—two or three-place ship. Will trade a good "Waco" powered glider with power and Model A Ford roadster, both in good condition.—Stanley H. Shontz, 324 S. Dorcas St., Lewistown, Pa.

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WANTED a licensed three-place ship preferably a radial. Will trade the following: A 1932 A Ford; 1, 17 ft. canoe, 12 gauge repeater, 20 gauge single, 22 Remington repeater.—George Orloff, 211 E. 159th St., Harvey, Ill.

ENGINES AND ACCESSORIES

HAVE MOTORCYCLE ENGINE, want 16 m.m. movie outfit.—R. H. Hunt, Oakland City, Ind.

WANTED—Parts for Model T racer. Drilled crankshaft, magneto, oil pump, aluminum pistons, etc. Will trade blueprints for Boutraeger's midget racer. What do you want?—Wilson Yowell, c/o Hotel Gleason, Charlottesville, Va.

WILL TRADE welded Heath tail parts for one pair of riding boots, size 7½, good condition.—Hans Heier, Route 2, Medford, Oregon.

HAVE 1929 HUP 4 pass. speed. in good cond., will trade for motorcycle or Pietenpol A. C. parts. Parts needed are Ford A motor flystructs, cowling, covering, control wires, instruments and dope, or what have you?—Leroy Overbey, 2542 S. Normal St., Chicago, Ill.

WHAT IS WANTED for Cycle motor? Have string instruments, flying model kits, sporting equipment, etc.—Leonard Lewis, 1412 E. Greenwood Ave., Nashville, Tenn.

WANTED a miniature gasoline engine. Have pair of ice skates or what do you want?—Clifford Gray, 503 N. Tacoma, Tulsa, Okla.

WANTED. Lawrance conversion, two-throw shaft with con rods or 3 cyl. Anzani motor. Have chemicals and chemical apparatus, etc. Also a B flat Buscher Cornet with case, etc. What do you want?—Gene Sabathier, 1018 N. Miro St., New Orleans, La.

WANTED Hispano Suiza Motor. Have rebored, fitted Model A, never run since. Make your proposition.—Leonard Stein, 5046 N. Kingshighway Bl., St. Louis, Mo.

WANTED for Golden Eagle Chief high wing, blue prints, right wing, motor mount, motor cowlings, fuselage fairings, tail plane, elevators and fin. State lowest cash price in first letter or have two racing outboard motors, one Evinrude Class C and one Elto Class B in trade.—Frank G. Edwards, Westminster Ave. and Nowell St., Chilliwack, B. C.

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GLIDER WANTED. I want a Glider in perfect condition. Have twelve gauge hammerless double-barrel shotgun and typewriter. Also spot cash.—Alex Crawford, Lexington, Okla.

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GLIDER OR LIGHTPLANE WANTED. Will consider a slightly cracked or nearly built job. Will trade a parachute and some cash or guns if worth it. Send photo and I will send mine.—Henry Swenson, Beltagh Road, Bellmore, N. Y.

MISCELLANEOUS

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WILL TRADE set unusual graflex photos of chute packing and jumping for present address of Jackie Somers, jumper, who borrowed—and forgot home route on some of my choice negatives.—Bob Jones, Plaza Hotel, Camden, N. J.

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TROMBONE, Mandolin, Boxing gloves, chest exercisers. Trombone is a Conn, silver plated, gold bell with case. Mandolin is high price instrument and almost new. Boxing gloves are 12 oz. each—set of 4, excellent condition. Chest exerciser resist up to 200 lbs. Have wall type too. Will exchange for Keystone 16 mm. Motor driven Movie projector Models D-62 or B-63 or A-74. Or Eastman, Paramount or other good machine. No toy machines wanted. Also want movie camera. Give model No., projector or camera and make, also year purchased and condition.—Robt. C. McInturff, Box 94, McGaheysville, Va.

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MOTOR BOAT WANTED, inboard. Will consider boat less motor if in excellent condition. I have a $200.00 complete mixed set of Ludwig and Leedy Drums for orchestra, including bells, etc., in excellent condition. Will add cash if necessary.—Thomas Ehrhart, 635 E. Market St., York, Pennsylvania.

MOTORCYCLE WANTED, or motorbike in running order. Will trade bicycle, 0.22 rifle, wood-turning lathe with two motors, telescope, books, etc.—Charles Daggett, Box 96, Blanchard, La.

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KEYSTONE, or other low priced 35 M. M. projector wanted. What do you want?—Arnold Holden, Bucyrus, N. Dak.

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MOTORCYCLES

MOTORCYCLE WANTED. Valued at $35-$50. What do you want in exchange?—George S. Homan, State College, Route 1, Pa.

MOTORCYCLE—I want a twin preferably an Indian in running condition or with little overhauling. Will exchange services as follows: motorcycle repair, airplane assembly, etc., aircraft, carbureters, printer's supply, typewriter repair.—C. A. Hightshoe, 5912½ Div., Chicago.

LIONEL ELECTRIC TRAIN, standard gauge, cost $25, used slightly, two airplane wheels 20 x 4, unused, G. E. ⅛ h.p. electric motor needs rewinding, other things. Want good Harley 45 twin motor, single motorcycle motor or Smith Motor Wheel.—Sanders Hudson, 1800 Angier Avenue, Durham, N. C.

END.

Helicopters

(*Continued from page* 104)

automobile has been driven by Opel and a rocket-powered speed boat by Max Valier, both in Europe, at tremendous speeds and almost unlimited acceleration. In America Dr. Robert H. Goddard has toiled unselfishly for many years in developing rocket aircraft; he has invented a rocket plane in which the rocket gases turn a turbine-operated propeller as long as the craft is in the atmosphere and operate to force the craft forward due to reaction from the gases when it is in the stratosphere.

These experiments show the trend toward rocket engines. They must and will prove efficient. In no other way that is known now can man, restless animal that he is, propel himself into space, which is his last physical frontier. The conquest of space, however, is a subject for a separate chapter. Let us return to the helicopter of the future.

Let us examine the common little Fourth of July whirligig. It is a small wheel with rockets about its rim. These rockets are fired one by one and the reaction from their expelled gases whirls the wheel around. It is a toy, but significant.

Back in 1883, Benjamin Waddy Maugham, a gas and water engineer, and Samuel Danks Waddy, both patented a helicopter whose airscrew was to be rotated by such a wheel. A chain of blank cartridges was exploded at intervals to turn the wheel, which in turn rotated the airscrew. This pioneer idea was at least sixty years ahead of its time.

Thomas A. Edison experimented with motors designed for helicopters. "I got some data," he said, "and made up my mind that what was needed was a very powerful engine for its weight, in small compass. So I conceived of an engine employing guncotton. I took a lot of ticker paper tape, turned it into guncotton, and got up an engine with an arrangement whereby I could feed this guncotton strip into the cylinder and explode it inside electrically.

"The feed took place between two copper rolls. The copper kept the temperature down, so that it could only explode up to the point where it was in contact with the feed rolls. It worked pretty well; but one machine roll didn't take it and the flame went through and exploded the whole roll and kicked up such an explosion that I abandoned it. But the idea might be made to work."

And by the way, this reminds me that Hiram Percy Maxin, the well-known inventor once experimented along these lines with a guncotton product or somewhat similar compound known as "Maximite," with which he propelled torpedoes and, later, model airplane motors.

His motors were of the reaction type, something like a multiple pin wheel, the gases from the burning Maximite issuing from various orifices driving the motor cylinders around with a considerable amount of power and with very little weight. These small motors, weighing not more than 4-ounces with fuel, could deliver about one-eighth horsepower for about 50 seconds. Maximite was very much more stable than guncotton.

Let us assume that the idea has been made to work and imagine a helicopter of the future, based on the inventions of Breguet, de la Cierva and Isacco, and powered by such an engine. The blades are hinged, after Breguet's fashion, to a tiltable mast, such as that of de la Cierva's latest type of autogiro, and powered by a rocket engine placed in each blade after the fashion of Isacco. The engine has tremendous power.

We start it and let in the clutch. Quickly we rise into the air. A few hundred feet up, we tilt the mast, shut off the wing engines and start up the guncotton engine that drives the forward propeller. Then, even better than the magic carpet of old, our apparatus smoothly, swiftly transports us to our destination—to our home twenty or thirty miles from our place of work, or to the bathing beach one hundred miles away.

All this, of course, is a dream. But I am convinced it is a dream that will come true. It will come true in the lifetime of most of us who are now witnessing the slow dawn of a truly scientific paradise on earth.

END.

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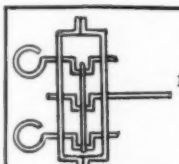

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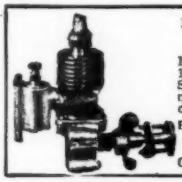

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1/8 x1/8, 30, 5c	1/8 x2", 6, 10c	¾x1½x10, 3, 5c
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Washers, L. or S. doz. 2c		Add 15c for postage

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Les Long

(*Continued from page* 99)

a great wrong. The course is simple. The Department should promptly begin the issuance of licenses for experimental aircraft, of limited power and non-passenger carrying type. The license would permit no more rights of interference than the present identification mark.

If this were done it would change the whole course of aviation. Thousands of young men would be overjoyed to start again where they were forced to leave off, and other thousands would join them. The schools would be filled again as they were before the great eclipse. Such attempts as the present commercial plan would really be successful and a flying public would be ready if needed.

END.

Bomber

(*Continued from page* 92)

rack which is required for heavy loads, was fitted to a Keystone B-5A airplane and a system of slings was devised whereby the bundles could be slung from the bomb rack.

Master Sergeant Samuel J. Davis, enlisted pilot of the 23rd Bombardment Squadron, Air Corps, was selected to fly the bomber and drop the bundles at the first opportunity. The first day, after several hours of patient waiting, he succeeded in dropping one bundle. Then three days of heavy, continuous rain prevented further trials; but on the fourth day the rain ceased, and Sergeant Davis resumed his bombing practice and succeeded in dropping the remaining two bundles.

END.

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Wild West

(*Continued from page 94*)

I dropped into a restaurant to get a cup of coffee before going to bed. While the waitress was filling the cups I did a little mental figuring.

"Oh well," I cogitated, trying to console myself, "I guess I haven't got so much to kick about after all. Here it is only four days since I started to jump chutes and look what I've got. Some swell riding boots and whipcord pants that'll let people know what I am, and besides that I've saved thirty dollars in cash—"

"Hey, Tex," broke in Web's voice, "It's going to take all the dough I got and more too to rebuild old Luke. You come board with me and gimme that thirty bucks . . . "

Yessir, brethren, I had a lot to learn about barnstorming—and another lesson yet to learn about chute jumping.

* * *

IT came about a week later. One morning we were working on the remains of Luke when we heard the sound of an OX5 over the field. It turned out to be an acquaintance from Legrande, Oregon, named Gene Cole, in one of the early type Eaglerocks—remember the old long winged babies with the square and blunt wing tips?

He was working the ship off a pasture at Legrande and wanted me to come up the following Sunday and make a jump.

Cole was a young fellow who had shortly before been washed out of the army air service, after eleven months, on account of "technicalities"—said technicalities being the aftermath of an idea that he would like to roll the wheels of his Liberty DH Observation job, that he was flying on a cross country trip, off the tops of some fast moving passenger coaches three thousand feet below.

He had circled down and made a pass at the train but had overshot the first time. So he circled around and tried it again. This time he came in low behind the last coach to be sure and get down far enough. *He did!* When he approached the rear car the vacuum from the moving train caught him and set him down right in the middle of the track at about ninety per. And with the usual luck, he stepped from the splintered wreckage with only an arm peeled from wrist to elbow and with a goose-egg on his forehead where it had slammed into the padded cockpit rim. So Gene had come home—washed out on "technicalities."

"Tex, don't you do it," Web said to me when Gene mentioned the proposed jump at Legrande. "I know that country like a book. Me an' Hugh Barker (Now flying for Trans-Continental) flew all over it. The town's right against a range of mountains and that's the screwiest bunch of air that I ever ran across. I know one barnstormer who flew a Jenny in there and took it out on a truck just because of the way that air acts when it comes down off those mountains. You better keep out of there."

But he might just as well have saved his breath. The thought of making a few dollars and getting to jump from a new-production job, coupled with Gene's, "Ah, it's all right—just a little bumpy. I've been flying up there for three weeks," brought me to instant decision. I agreed to go, and the next Sunday loaded my chute aboard the train—at two o'clock in the morning—and went up.

We had quite a nice sized crowd on hand for the jump and I took up a pretty nice collection. But when it came time for me to jump I was just a bit nervous. Not only was I thinking of Web's warning but I'd been watching the wind-sock all afternoon. One minute it would be hanging limp and the next minute it would be standing straight out and swiveling a bit on the socket. It don't take much of a breeze to make things uncomfortable for a man coming down in a chute.

But up we went, Gene climbed the Eaglerock to nineteen hundred feet through some of the bumpiest air that I've ever got into. He leveled her off, cut the gun, and I went off the wing with my old thirty-two foot exhibition chute. She ballooned out about a hundred feet below the ship and promptly began to oscillate wildly. Try as I did, I couldn't do anything with her. Perhaps it was my inexperience, perhaps the wind, but I do know that I was making thirty or forty foot swings from side to side and going up so far as to cause the edges of the chute to pull in and partly collapse when my weight left it for a second.

Then I'd come swishing back and down and go up on the other side. For about seventeen hundred feet I fought those shroud lines, pulling this way and that in every manner that I could think of; but I might just as well have let them alone for all the good it did. A hundred feet above the ground I gave up and quit. I came down in one last wild swing, barely missed the ground, and when I did land the chute was a close second.

I hit the dirt, my knees came up and knocked all the wind out of me, and I sprawled on the ground with a wrenched knee and two sprained ankles. Half an hour later I was able to breath normally again and was hobbling about on two swollen ankles.

What a whollop! But who could foretell that there was a literal Niagara of boiling air currents, whirlpools and tornadoes playing around when I hopped off the crate to do my stuff? Bumpy? I'll say she was bumpy and chock full of what the French call "remous."

Late that afternoon I was on a train speeding back towards Idaho and the home field—vowing everytime we passed a telegraph pole that from now on I'd pay a little more attention to older heads, that I'd cut out trying to be a brave grandstand hero and prolong my absence from hospitals. Further, that Legrande and its beautiful mountains could go to h—l as far as I was concerned.

I learned about jumping chutes in screwy air from them!

END.

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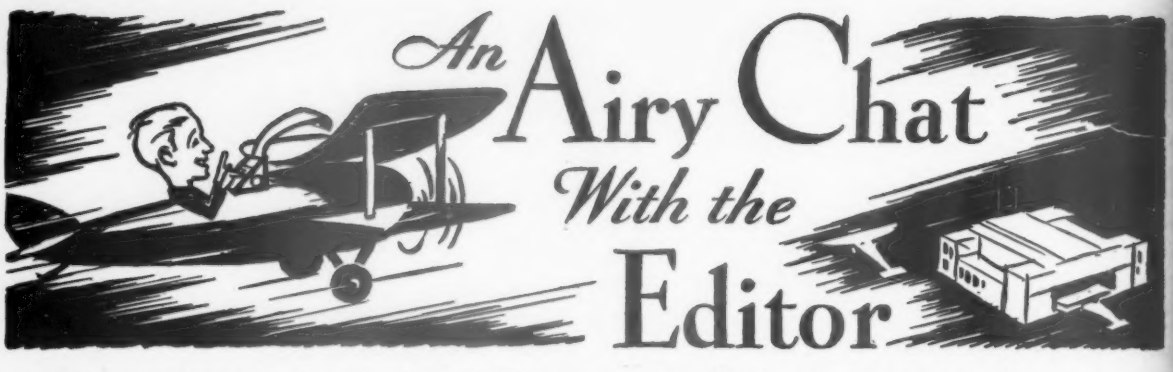

An Airy Chat With the Editor

AHOY, FELLOWS! That contest for discovering the error on the cover of the October issue (or was it November?) has been over for a long time. We gave the "dead-line" and also published the names of the winners, but does that stop more entries from piling in? Absolutely no. The total number received to date is 1,053 letters on the subject, and unless this notice reaches all of you, I expect about 500 more. Wow, what a response?

* * *

FOR MONTHS we have expected that a letter like this one would blow in, but when it did arrive, some days ago, the shock was none the less severe. What was it? Well, it was from a guy who wanted the date on which Lindbergh invented the airplane.

* * *

THE DEMAND for pictures of wartime planes and war stories continues unabated. Unless someone starts a good healthy war in the near future, I'm afraid that we will run out of original material. It takes a mighty strenuous year of wartime activity to supply a continuous series of aeronautical material for fifteen years of magazine stories, and I am afraid that we will have to drop the true story idea and take up fiction unless we have some military action in the near future.

* * *

I WONDER how the repeal of the eighteenth Amendment is going to affect aviation. Beginning promptly on June 21, 1933, the graphs issued on automobile accidents by the Department of the Census showed a big pick-up in the number of auto accidents. And this was only beer. What will the charts for December, January and February show? Pretty soon they will be pasting A. T. C. stamps on the bottles.

* * *

STRANGE—NOBODY has yet suggested giving aeronautical training for the members of the C. W. A. Perhaps this is for the reason that most of the military aviation interest is taken up with the C. C. C., at least the latter organization has absorbed a lot of the Air Corps officers.

* * *

WE SEE in the daily papers that two more planes have got tangled up with the high-tension pole-lines. And there'll be more before 1934 is over. These power lines are a menace to aviation and something should be done about it. This is a real problem for the D of C to take up.

* * *

ONE NEW regulation that we'd like to have incorporated into the laws governing flying is a little line reading: "All airplanes shall be equipped with dumping fuel tanks, which when opened by a lever within easy reach of the pilot, shall completely discharge all of the gasoline, oil or other combustible liquids, within five seconds of the time that said lever is actuated by the pilot." Paging Mr. Director of Aeronautics, Washington, D. C.

William Ong, well known racing pilot who contributes an illuminative article on the air races in this issue. See page 149.

* * *

LIGHTPLANERS ARE divided into two camps. (1) Those who are using converted motorcycle engines. (2) Those who are using converted Ford engines. And how these two factions love each other—not. But take my word for it, Ladies and Gentlemen, both of these types work—though much improvement can be made in both of them.

The motorcycle contingent take an unfair crack at the revamped Model "A" by claiming it is too heavy. On the other hand, the Model "A" owners slap the motorcyclists on the wrist by saying that their engines have no power. And so it goes, but in the end they both get fair flights at very little expense.

* * *

GET A GOOD cheap aviation engine, and the lightplane situation will solve its own problems. No need for the Director of Aeronautics to worry about a $700 lightplane. That will develop out of the basements, barns, woodsheds and kitchens of America as soon as we get a good engine—say for $100 to $150. It is the high-priced aviation engine that has helped to tie up the game since 1909.

* * *

SUCH AN ENGINE need only be a little lighter than a Model "A," and should be reliable first and economical —second. This is the reason why the writer believes that a good rugged two-stroke-cycle engine is the berries for this purpose. It is simple, inexpensive, easy to maintain and only a little tougher on the gasoline than a good four-stroke engine.

There are no valves to stick and burn out, no intricate gears and cams to monkey with and very little trouble of any kind. In their present state, they are sometimes hard to start, but there is no apparent reason why this bug cannot be ironed out by the use of improved carbureters.

* * *

IT TAKES courage to come out and make a remark that slaps Old Man Tradition and sacred aviation creeds in the face, but a fact is a fact and I can't withstand the temptation to let out a roar when some new design outrage makes its appearance. Generally, said outrage is based upon principles long ago found to be useless or dangerous.

If I were again building up an aeronautical course, one of the most important of all items on the bill-of-fare would be a good rigorous course on the History of Airplane Design. We would start 'way back from the beginning and progressively take up arrangements that were a success or failed and tell why they succeeded or failed.

(*Continued on page* 186)

XU